UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

MAR 12 2004

In response refer to:
151422SWR01SR247:KAJ

RECEIVED
MAR 19 2004
MPWMD

Lt. Colonel Michael McCormick
U.S. Army Corps of Engineers
San Francisco District
333 Market Street
San Francisco, California 94105-2197

Dear Colonel McCormick:

This document transmits the National Marine Fisheries Service's (NOAA Fisheries) programmatic biological opinion on the United States Army Corps of Engineers' (Corps) permit pursuant to section 404 of the Clean Water Act (33 U.S.C. 1344) for Monterey Peninsula Water Management District's (MPWMD) Carmel River Restoration and Maintenance Regional General Permit (RGP). The project is proposed to occur in the Carmel River, located in Monterey County, California. The programmatic biological opinion analyzes the effects of the proposed project on the threatened South-Central California Coast (SCCC) steelhead (*Oncorhynchus mykiss*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

NOAA Fisheries concludes in the programmatic biological opinion that the proposed RGP will not jeopardize the continued existence of SCCC steelhead. NOAA Fisheries expects activities occurring under the RGP are likely to result in take of SCCC steelhead and, therefore, an incidental take statement is enclosed with this programmatic biological opinion. Project specific letters confirming compliance with the programmatic biological opinion will be issued for individual activities authorized under the RGP.

If you have any questions about this section 7 consultation, or require additional information, please contact Ms. Korie Johnson at (707) 575-6096.

Sincerely,

Rodney R. McInnis
Acting Regional Administrator

Enclosure

cc:

Jim Lecky, NOAA Fisheries
Phelicia Gomes, Corps, San Francisco
Kevan Urquhart, California Department of Fish and Game, Monterey
Diane Gunderson, United States Fish and Wildlife Service, Ventura
Larry Hampson, MPWMD

PROGRAMMATIC BIOLOGICAL OPINION

ACTION AGENCY: U.S. Army Corps of Engineers, San Francisco District

ACTION: Carmel River Restoration and Maintenance Regional General Permit

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

FILE NUMBER: 151422SWR01SR247

DATE ISSUED: MAR 12 2004

I. CONSULTATION HISTORY

On July 14, 2000, the U.S. Army Corps of Engineers (Corps) issued Public Notice No. 24460S for the proposed Carmel River Restoration and Maintenance Regional General Permit (RGP). On September 20, 2000, National Marine Fisheries Service (NOAA Fisheries) received a letter from the Corps initiating formal Endangered Species Act (ESA) section 7 consultation on the project. On October 17, 2000, the Monterey Peninsula Water Management District (MPWMD) requested that the Corps suspend permit processing until February 1, 2001, in order to resolve concerns raised during public comment on the Public Notice. On October 23, 2000, NOAA Fisheries requested additional information in order to begin formal consultation. NOAA Fisheries received the additional information on January 25, 2001. Formal consultation was "restarted" on February 1, 2001. During a series of meetings, U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), NOAA Fisheries, and MPWMD agreed to changes to the project description for the RGP to further minimize adverse effects to listed species. The project description was finalized in May 2003.

In many cases, projects included in this RGP are described under the Corps' Nationwide Permit program; however, because two species, steelhead (*Oncorhynchus mykiss*) and California red-legged frog (*Rana aurora draytonii*), are listed as threatened under the ESA, most activities to be covered by this RGP would require individual written authorization from the Corps. This RGP will allow activities to be carried out without obtaining individual Corps authorization.

This programmatic biological opinion is based on information provided in the biological assessment, the project proposal, meetings and telephone conversations with MPWMD staff, field investigations, and other sources of information. A complete administrative record of this consultation is on file in NOAA Fisheries' Santa Rosa office.

II. DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to authorize an RGP pursuant to section 404 of the Clean Water Act for MPWMD to conduct river maintenance, restoration, and enhancement activities and authorize similar privately-sponsored activities within a 17.3-mile segment of the Carmel River extending approximately one mile upstream from the Pacific Ocean and extending to, but not including, the San Clemente Dam at River Mile (RM) 18.6. The RGP would be effective for ten years with work conducted between July 1 and October 31 of each year. The proposed project would restore bank stability and channel meanders in unstable areas and reestablish or enhance riparian resources in areas impacted by large storm events and/or low water conditions. This RGP does not authorize activities implemented during an emergency situation (*i.e.*, flood). Rather, section 7 consultation for emergency activities shall be completed using expedited emergency consultation procedures (50 CFR 402.05, USFWS and NOAA Fisheries 1998). Activities authorized under this RGP are expected to benefit habitat conditions for steelhead.

The intent of the RGP is to streamline the permit process for those agencies and landowners who are interested in the following types of projects:

- Maintenance:
  - installing erosion protection in unstable, degraded areas; and
  - limited removal of vegetation and woody debris from the active channel.

- Restoration:
  - channel restoration in unstable areas;
  - reestablishing riparian vegetation along stream banks and adjacent areas; and
  - maintenance or repairs of previously authorized restoration activities.

- Enhancement:
  - excavation of pool and riffle sequence;
  - placement of large woody debris (LWD) and boulder groups;
  - injection of spawning gravels; and
  - establishing riparian vegetation along stream banks and adjacent areas.

Based on the current MPWMD staff level, limitations to the construction period normally imposed by various agencies (*e.g.*, CDFG, USFWS, NOAA Fisheries) and other constraints to work in the river (*e.g.*, high flows, spawning, smolt and adult migration), the number and size of each project will be limited. The annual maximum scope of work proposed under this RGP would limit MPWMD-sponsored restoration and maintenance projects to a total of ½-mile (2,640 linear feet [ft]) of stream channel annually. Privately-sponsored projects would be limited to a total of 1,000 linear ft of stream channel annually. Selective hand clearing of vegetation and woody debris management would be limited to a maximum of three miles of stream length per year. Fisheries enhancement projects sponsored by MPWMD that do not require dewatering or fish relocation would be unlimited, because these are projects with beneficial effects resulting in only minimal potential temporary adverse impacts during the construction period. Fishery enhancement projects requiring dewatering and/or fish relocation would be limited to 1,100 lineal ft of stream channel per year (600 lineal ft for critical riffle modification and 500 lineal ft for installation of LWD).

A. Proposed Activities Covered by the RGP

1. Installing Erosion Protection

Natural events and human activities have led to accelerated erosion, channel degradation, and loss of riparian habitat along a large segment of the Carmel River. Under this RGP, MPWMD would implement or authorize installation of erosion protection in areas degraded by scour and lack of vegetation to aid recovery of the riparian ecosystem.

a. Excavation and Backfill

Grading of the river banks may be required to recontour or reduce the slope of the existing bank to 1.5:1 or flatter. In cases where the river bank is being severely undercut or eroded, the toe of the bank may be stabilized by excavation of a toe trench, up to several feet deep below the adjacent channel bottom, and backfilling the trench with riprap and/or incorporating a biotechnical method to prevent scour. Material excavated from such trenches would normally be placed on the streambanks.

Temporary fill for access may be required to allow equipment into the work area. Excavation and fill may be necessary for a temporary flow diversion structure (if necessary). Excavation activities could include the use of a backhoe to dig planting holes for trees and to trench irrigation lines. Prior to the start of channel grading work, salvageable vegetation along the project reach may be removed with mechanized equipment and relocated within the project. In areas where the banks have been severely eroded, excess channel or gravel bar material may be excavated, stockpiled, and used as backfill material. Only material above the level of frequent flows (*i.e.*, the 1.5- to 3.0-year return flow) will be excavated for backfill. Fill material required for bank stabilization projects may include rock slope protection, vegetative material, and other material such as boulders and logs. Fill material could also include topsoil that would be placed over riprap and along regraded banks.

b. Importation of Fill Material

Areas with property loss could be backfilled to a pre-loss configuration. Imported soil shall be free of deleterious material and be coarse grained (*i.e.*, have some gravel in it), sandy loam, loamy sand, or sand. Fill material will match, as nearly as possible, the grain size distribution found within the project area. As with excavation and backfill activities, streambank areas could be stabilized with structural and/or biotechnical erosion protection in key areas.

c. Slope Protection

Slope protection may be installed along unstable, degraded areas of banks that have eroded and are causing sediment input into the river or are threatening structures along the riverbank. It should be noted that all bank stabilization projects conducted under this permit will incorporate bioengineering techniques as the first choice of construction methods.

Where bank erosion occurs within 25 ft of public or private infrastructure (including, but not limited to, roads, buildings, bridges, and utilities), riprap, gabion baskets, or other traditional slope protection will be used. Gabion baskets will be restricted to slope areas higher than eight ft above the channel bottom. Where structures are not within 25 ft of an erosion site, no more than eight vertical ft of riprap will be used above the channel bottom.

The majority of these sites are located on the outside of meander bends or in areas where bank vegetation has eroded away. Slopes protected by structural erosion protection will be built at a 1.5:1 (horizontal to vertical) grade or flatter.

Other slope areas will be constructed at a 2:1 (horizontal to vertical) grade or flatter. Erosion protection installed on these slopes could be geotextiles, live plant material, logs, rootwads, or other flexible types of erosion protection. At the outside of bends and in critical erosion areas, a combination of erosion-resistant materials, log deflectors, riprap, and vegetation will be installed to provide bank protection in case of high flows. Erosion protection installed along the outside of meander bends may consist of granite riprap in the 1/4- to 3-ton class, if it is infeasible to install bioengineered structures. This structural protection will eventually blend into vegetation planted on the bank and along the toe of the riverbank. Filter fabrics that act as a barrier to root development will not be allowed. Other filtering materials such as biodegradable filters, gravel filters, or "backing rock" would be used. One exception would be for slope protection of public or private infrastructure that is within 25 ft of the active channel.

Note: The active channel refers to the lowest portion of the main stem channel that is occupied by flows of between the 1.5-year and 3.0-year return frequency. Generally, for the Carmel River, this is the area within the bottom of the channel that is inundated by four to eight ft (vertically) of flow. This corresponds roughly with the Corps' wetlands jurisdictional limit.

d. Temporary Diversion Channel

Where necessary, in order to divert flow around a work site in areas of perennial flow, a trench will be excavated, usually in a dry portion of the channel bottom, to pass flow around the site. A trench is used rather than piping to allow flexibility with changing stream flows, avoid increased water temperatures within a pipe, and to allow fish to move through the project area over natural substrates. Material excavated from the trench (primarily sand, gravel, and cobble) will be used to temporarily block the bottom of the channel and divert flow into the excavated trench for the duration of the project. After construction is completed, the diversion berm will be removed, and the excavated trench area filled in to pre-existing contours.

Prior to diverting flow around a work site, fish will be rescued and removed from the site. Porous fish fences and/or rock barriers will be set up to prevent migration into a repair site. Fish fences (plastic mesh) are less desirable than rock barriers, as they require daily cleaning due to algae and other organic build-up and are subject to failure if flow fluctuates. Once the porous rock barriers are set up at the head and tail of the repair site, flow shall be gradually reduced through the site to maintain viable habitat conditions and improve efficiency of capture gear, which can include 1/4" stretch mesh beach seines and electrofishing gear. If flow in the river is perennial or nearly so throughout the river, fish located in repair sites can be captured with a variety of techniques designed to minimize capture stress, direct mortality from acute physical injury, and delayed mortality from mild injuries. Multiple passes with capture equipment may be needed to ensure that 95 percent of the fish are captured before the repair site is dewatered and all surface flow is shifted to the diversion. Electrofishing techniques will follow guidelines established by NOAA Fisheries. The minimum amount of current and voltage will be used to ensure capture of 95 percent of the fish during three repetitive passes through the repair site over a one-day period. In no case will output voltage exceed 300 volts.

Captured fish will be placed in an insulated, oxygenated tank filled with Carmel River water, and transported to areas of perennial flow or to the MPWMD Sleepy Hollow facility. Water temperature in the tank will be controlled by using ice if necessary. Generally, fish will not be placed downstream of a repair site, as habitat conditions usually decrease in the downstream direction due to reduced flow and increased water temperature. Fish could be placed downstream of a repair site, however, if conditions allow. The data on cumulative catch and catch per unit effort will be used to estimate total population size in the repair site.

2. <u>Vegetation and Woody Debris Management</u>

Since the Fall of 1990, MPWMD has carried out annual channel clearing projects along portions of the Carmel River to reduce the potential for bank erosion and to maintain channel capacity. Vegetation growth and sediment deposits trapped by vegetation decrease hydraulic capacity of the river channel and may cause debris jams that increase the potential for bank erosion and damage to public infrastructure. In addition to erosion hazard reduction for property, channel clearing objectives include removing trash and inorganic debris from the river channel and maintaining aquatic habitat.

MPWMD proposes to modify or remove vegetation and wood from the channel bottom under a limited set of circumstances and with full recognition of and mitigation for impacts associated with such activity. These activities would follow MPWMD's <u>Final Guidelines for Vegetation Management and Removal of Deleterious Materials for the Carmel River Riparian Corridor</u> (MPWMD 2003). Streamside plants growing on adjacent riverbanks would not be affected. Vegetation cutting normally will be done by hand crews using hand tools and hand-held power tools. Some cut vegetation will be chipped on the terraces above the riverbank or utilized in MPWMD bank stabilization projects elsewhere along the river. Large wood (defined here as four inches or greater in diameter or three ft or longer in length) may be modified under certain circumstances, but would be left in the channel.

3. Channel Restoration

Channel restoration may be used to realign the river channel if, during high flows, the river scours a new meander bend or channel through the floodplain, resulting in unstable, vertical banks. Projects normally will include excavation and backfill to realign the channel and slope the vertical bank, excavation of a meandering, lowflow channel with a pool and riffle sequence within the realigned channel, and replacement of cobble and gravel material along the channel bottom.

a. Excavation and Backfill

Excavation and fill activities will be required to implement channel restoration projects. Excavation of sand and gravel bars may be carried out to realign the active channel into a more stable configuration. This is a key component of reestablishing meander geometry and recreating low-lying floodplain areas outside of the active channel. A channel capable of carrying dominant or frequent flows (*i.e.*, 1.5- to 3.0-year events) will be excavated within the channel bottom. This active channel meanders back and forth and generally has a wavelength of between 1,000 and 2,000 linear ft. The amplitude of meanders is frequently dictated by existing constraints; however, where possible, an increase in amplitude would be desirable. For large restoration projects, this activity is frequently combined with installation of erosion protection at critical areas, such as at the outside of meander bends.

In most cases, large equipment such as a front end loader, dump truck, backhoe, bulldozer, or excavator will be used to restore channel geometry to a more stable alignment. Temporary fill for access may be required to allow equipment into the work area. Excavation and fill may be necessary for a temporary flow diversion structure (if necessary). Prior to the start of channel grading work, salvageable vegetation within the project reach will be removed with mechanized equipment and relocated to bank stabilization project areas. Contractors will be required to skim the top four- to twelve-inch layer of gravels within the channel and stockpile it, replacing it back onto the channel bed once the restoration work is completed.

b. Channel Realignment

Project work starts by surveying and staking project boundaries to prevent heavy equipment operation outside the work area. The contractor begins grading by scraping off the "upper" layer of the riverbed, which contains the largest proportion of cobbles and gravel. Deleterious material, such as auto parts, various metal objects, and refuse, will be hauled away to an appropriate dump site outside Corps'jurisdiction. The channel is then regraded, with channel materials excavated from areas of deposition and backfilled into areas of erosion. The finished channel will be designed to carry excess sediment stored in point bars located within and upstream of the project. Material excavated from the channel can be used to buttress eroded slopes and to build an active floodplain for vegetation plantings. In some cases, riprap may be keyed into the toe to stabilize eroded slopes. After completion of this work, a smaller lowflow channel is excavated within the main channel. This lowflow channel provides fish passage for migrating steelhead during periods of low flow. Pools are excavated at appropriate intervals (usually five to seven channel widths) to provide areas for migrating steelhead to rest and feed and to provide habitat for California red-legged frog. In most areas the finished stream bottom will be at or near the elevation of the existing channel bottom.

Channel alignment projects will incorporate the following design criteria to re-establish a lowflow channel and stable bankfull channel, and to establish pool and riffle sequences within the new channel. These criteria are based on analysis completed by MPWMD during previous channel restoration projects on the Carmel River (November 8, 2001, letter from MPWMD to NOAA Fisheries):

1. The lowflow channel should be 65 ft wide in portions with slope between 0.005 and 0.010 and 75 ft wide in areas with slope less than 0.005.

2. Depth of the lowflow channel should allow adjacent areas within the bankfull channel to flood during one- or two-year return events (approximately 4-6 ft in depth).

3. Horizontal channel alignment should simulate the 1966 alignment, where feasible.

4. Vertical alignment (pool-riffle sequence) should approximate the pre-project alignment.

If existing streamside ponds or pools are filled in during channel and floodplain construction, this action would be offset by the creation of new pools and/or low-lying floodplain areas adjacent to the new active (*i.e.*, bankfull) channel.

4. <u>Re-establishing Riparian Vegetation</u>

Banks and low floodplain terraces will be revegetated with willow, cottonwood, sycamore, box elder, elderberry, and other native riparian species. Special emphasis will be placed on revegetation with plant species that are appropriate for the restored bank or terrace elevation and moisture condition. The integration of top soil into the slope assists in the retention of moisture and provides a more nutrient-rich medium for root development. In several of MPWMD's restoration areas, the willows are sufficiently large that cuttings for other projects can be taken.

All graded slopes, including rip-rapped areas, will be revegetated with cuttings or seedlings on a four- to seven-ft grid. As a component of re-establishing native riparian cover, an irrigation system will be installed (if needed), operated, and maintained for a minimum of three years. If feasible, appropriate low-lying areas may be irrigated to provide refugia for wildlife. Weed removal would continue for a minimum of three years. MPWMD standards for the Carmel River include replanting of native riparian vegetation in areas that do not achieve a 70 percent success rate by year three after initial planting.

Revegetation and irrigation will also occur in areas impacted by water extraction. These efforts will occur throughout the riparian corridor along streambanks, in floodplain areas, and occasionally in terrace areas. Plantings will include many of the woody riparian species found in the Carmel River drainage and several understory species.

5. Maintenance of Previously Authorized Restoration Sites

One of the goals of MPWMD's river projects is to carry out works that will eventually need no maintenance or irrigation. However, floodplain development, two existing main stem dams, and water extraction practices disrupt restorative processes that would normally occur in the riparian zone after episodes of erosion. Restoration projects may require maintenance work either to repair flood damage or to stabilize a project after initial construction.

Maintenance work normally includes irrigation operation and repair, weed removal, and installation of supplemental plantings. For MPWMD-sponsored projects, MPWMD normally enters into a 10-year agreement with landowners to perform this type of activity. For privately-sponsored projects, MPWMD requires maintenance for a three-year period, which is a generally accepted period for plant establishment.

Restoration projects using techniques that rely on streamside vegetation for erosion protection are vulnerable to damage from high flows in the first few years after plant installation. For this reason, repairs may be required to stabilize damaged areas. A combination of methods and techniques previously discussed would normally be used in repair work.

6. Fisheries Habitat Enhancement

Improvement of degraded anadromous fisheries resources in the lower Carmel River watershed has long been considered a primary goal of MPWMD's river restoration program. Several activities are proposed by MPWMD to enhance or restore steelhead habitat. Fish habitat enhancement projects include excavation of a pool and riffle sequence after reestablishment of a stream channel, placement of log and boulder groups at erosion protection locations to provide additional habitat, replacement of gravel material along the channel bottom, floodplain restoration, riffle passage modifications, and revegetation of riparian habitat along the banks of the river. These actions will reduce the potential for bank erosion that degrades aquatic habitat and will increase the availability and quantity of rearing and spawning habitat.

Live plant material, logs, and rootwads will be incorporated with slope protection, including boulders, to provide shelter and cover for juveniles as well as substrate for macroinvertebrates.

Large woody debris also may be installed at discrete locations without bank slope protection to enhance steelhead habitat.

Riffles resulting in passage barriers (i.e., critical riffles) may be modified using hand tools, a portable crane, handwinch, and/or small portable dredge. Modification would include excavating a small channel through the critical riffle to concentrate flows and improve steelhead passage over the riffle.

Spawning gravels may be placed at various locations between Carmel Valley Village and the upstream limit of the RGP. These gravels will be delivered to the channel by dump trucks unloading gravel along the streambank and allowing high flows to distribute the gravels downstream. This is intended to result in the re-establishment of substrate suitable for spawning and macroinvertebrates.

B. Avoidance/Minimization Measures for Adverse Impacts to Steelhead

In order to minimize and avoid impacts to steelhead, projects approved by MPWMD will adhere to the following conservation measures:

1. <u>Harassment from In-Water Construction or Activities</u>

- The work window for construction projects will be between July 1 and October 31 of each year.
- Construction will occur only in the dry stream channel by being separated from flowing water, or if the channel is dry seasonally by being conducted during the dry period.
- Listed steelhead in the project area during construction activities will be removed prior to the onset of activities.

2. <u>Dewatering or Water Diversions</u>

- No redds will be dewatered when eggs or alevins are present.
- The stream channel will be returned to its original state at the completion of dewatering and construction.
- The duration of dewatering will be minimal.
- The dewatering method will minimize harassment, risk of mortality, risk of entrapment, and risk of stranding of steelhead.
- Projects that require dewatering of the stream channel will first avoid dewatering the entire channel in order to maintain passage for steelhead by methods such as the following examples: use of a washed, clean gravel berm slowly placed to displace steelhead without crushing any; inflatable bladders from behind which fish are chased away.
- Projects requiring entire stream dewatering will incorporate the installation of a coffer dam and temporary bypass channel, or other methods which minimize impacts to steelhead.

- Channel and bank disturbances will be first avoided, then minimized, during placement of the dewatering "structure."
- Any wastewater from project activities and dewatering will be disposed of off-site or in a location that will not drain directly into a stream channel or carry sediment-laden water into a stream channel.
- After construction, when water is returned to the construction area, the habitat will be accessible to steelhead.

3. Fish Rescue and Relocation

- For projects involving dewatering and/or relocation, project proponents will use fisheries biologists familiar with identification and handling of all life stages of listed steelhead to monitor the specific project area.
- Prior to and during stream flow diversion and dewatering, the biologist will capture any steelhead that may become stranded in the residual wetted areas as a result of project activities and relocate the individuals to the nearest suitable instream location immediately upstream or downstream of the work area.
- All fish will be moved promptly and transported in insulated containers filled with cool, well-oxygenated water. Fish will be captured, held, and transported according to MPWMD's Recommended Number of Juvenile Steelhead in 5-, 125-, and 400-Gallon Containers, at Loading Densities Ranging form 0.02 to 0.1 Kg/Kg Guidelines.
- The fishery biologist will note the number of individuals observed in the affected area, the number of individuals relocated, and the date and time of the collection and relocation.
- All efforts will be taken to neither exhaust nor kill listed steelhead during collection and relocation.
- The fishery biologist will be empowered to halt work activity for steelhead collection.

4. Construction Access and Temporary Stream Crossings

- The work window for construction projects is from July 1 to October 31 of each year.
- Construction impacts are confined to the absolute minimum area necessary to complete the project, and the site will be rehabilitated prior to October 31 each year.
- Damaged areas will be restored to pre-work conditions. Where the site will be revegetated or restored, top soil will be stockpiled for redistribution on the project area.
- Temporary crossings will pass all listed steelhead in the stream concurrent with the crossing.
- Temporary crossings will be removed prior to October 31 each year.
- Flatcar bridges with preconstructed footings will be used if they create less impacts than temporary culverts.

5. Impediment to Upstream or Downstream Migration by Listed Steelhead During Water Diversion/Bypass Construction Activities

- Temporary migration impediments will occur only during non-migratory periods.
- The amount of time a temporary migration impediment is in place will be restricted to the minimum necessary to complete the project.
- If a bypass pipe is installed, depending on the site and potential impacts to listed steelhead from being in the bypass pipe, the pipe will be screened in accordance with NOAA Fisheries screening criteria (NOAA Fisheries 1996, NOAA Fisheries 1997) to prevent fish from entering. Alternatively, pipe that facilitates migration will be used, for example, a pipe containing baffles and that is kept out of direct sunlight to prevent warming.

6. Degradation of Water Quality and Channel Structure from Turbidity or Sediment Plumes and Toxics and/or Petroleum Products from Machinery

- Construction will occur only between July 1 and October 31.
- Construction will be avoided when eggs or alevin are in the gravels downstream.
- Excavation in streambanks will be isolated so that water is prevented from entering the excavated area until the project materials are installed and erosion protection is in place.
- Effective erosion control measures will be in place at all times during construction. Construction within the 5-year floodplain will begin with placement of all temporary erosion controls (*e.g.*, straw bales, and silt fences that are effectively keyed in) downslope of project activities within the riparian area. Erosion control structures will be maintained throughout and, if needed, after construction activities.
- Sediment will be removed from sediment controls once it has reached one-third of the exposed height of the control. Whenever straw bales are used, they will be staked and dug into the ground 12 centimeters (cm). Catch basins will be maintained so that no more than 15 cm of sediment depth accumulates within traps or sumps.
- Sediment-laden water created by construction activity will be filtered before it enters the stream network or an aquatic resource area.
- A supply of erosion control materials (*e.g.*, straw bales and clean straw mulch) will be kept on hand to respond to unanticipated storm events or emergencies.
- The use of end hauling will be maximized to reduce the temporary stockpiling of earth to be removed from the project site.
- Temporary stockpiling of earth during wet weather will be avoided.
- Concurrent with projects occurring during wet weather, erosion control (protection or stabilization) will be used on stockpiles (all of which will be temporary and unavoidable) and exposed soils. Soils will not be left exposed overnight; exposed soils will receive final erosion protection as soon as that area will not receive further disturbance, and all areas will be stabilized within seven days of project completion or prior to forecasted rain, whichever is sooner. Movement of soil off of stock piles will be prevented, for example, by covering any temporary stockpiles with plastic sheeting or tarps; and/or installing a berm around the stockpile; and/or preventing the overland flow of water from upslope road or hillside from contacting stockpile; and preventing any water-carrying material from a stockpile from entering the aquatic ecosystem.

- Material removed during excavation will be placed only in locations where it cannot enter stream networks. Conservation of topsoil (removal, storage and reuse) will be employed.
- Sediment wedges that may be released by a proposed project will be removed to an upland location, placed in a location where they cannot enter stream networks or road drainages that are hydrologically connected to a stream and stabilized.
- After project completion and prior to October 31, all exposed soil will be stabilized, for example, using erosion control seeding and mulching. Placement of erosion control blankets and mats (if applicable) will occur within seven days.
- Efforts will be made to cover exposed areas as soon as possible after exposure.
- Temporary fill will be removed in its entirety prior to October 31 of the year of activities.
- Areas for fuel storage and refueling and servicing of construction equipment and vehicles will be located in an upland location.
- All equipment that is used for in-water work will be cleaned to remove external oil, grease, dirt, and mud prior to placing the equipment in the water; wash sites will be placed so that wash water does not flow into flowing waters or wetlands; equipment will be in good condition showing no signs of leaking fuels or fluids.
- Petroleum products, chemicals, fresh cement, or deleterious materials will not be allowed to enter flowing waters.
- Water contaminated by petroleum products, chemicals, fresh cement, or deleterious materials will not be allowed to enter flowing waters.
- In the event of a spill, the permittee will stop work immediately, begin clean up, and notify the appropriate authorities.
- Spill clean-up supplies (*e.g.*, absorbent booms when working in live streams) will be on site, and operators know will how to employ them.

7. <u>Loss of Large Woody Debris (LWD) and In-Channel Vegetation from Vegetation Management Activities</u>

- The amount of in-channel vegetation removal will be minimized to only what is necessary, as determined by MPWMD, to reduce erosion and potential bank failure.
- Only in-channel vegetation larger than three inches in diameter will be removed.
- Vegetation clearing will be done with the use of hand tools and hand-held power tools.
- Only LWD that poses a hazard to public facilities (*e.g.*, bridges) will be notched and left in the channel to break apart if mobilized; otherwise, all LWD will be left undisturbed in the channel. When notching LWD, the core 30 percent of the diameter of the tree or six inches, whichever is greater, will remain unnotched.
- Heavy equipment used to remove saplings and rootwads for salvage and replanting will operate only in the dry channel bed.
- Compaction will be minimized by using equipment that either has (relative to other equipment available) less pressure per square inch on the ground or a greater reach, thus resulting in less compaction or less area overall compacted or disturbed.

8. Loss of Riparian Vegetation

- All native trees and brush will be retained as feasible, emphasizing the shade-producing and bank-stabilizing trees and brush.
- Project designs and access points will be used that minimize riparian disturbance without affecting less stable areas that may increase the risk of channel instability.
- Compaction will be minimized by using equipment that either has (relative to other equipment available) less pressure per square inch on the ground or a greater reach, thus resulting in less compaction or less area overall compacted or disturbed.
- Disturbed areas will be revegetated with native plant species. Coring for revegetation will help to decompact soils. The species used will be specific to the project vicinity and comprise a diverse community structure (plantings should include both woody and herbaceous species).
- A ratio of three plantings to one removed plant (3:1 ratio) will be used.
- Unless otherwise specified, the standard for success will be 70 percent survival of plantings after a period of three years.
- Broadcast planting of seed results in 70 percent ground cover after a period of three years.
- Mitigation and restoration sites will be monitored yearly in spring or fall months for three years. If there is not 70 percent survival after three years, all plants that have died will be replaced during the next planting cycle (generally the fall or early spring) and monitored for a period of three years after planting.
- If chemical fertilizers are applied, fertilizer will not enter the hydrologic network and will not be carried by runoff into the hydrologic network.
- Herbicides will not be applied in the project area, except at MPWMD irrigation sites to control poison oak and non-native invasive species. Only the use of *Rodeo*© or a technical grade of glyphosphate (without surfactant) will be allowed.

9. Bank Hardening and Associated Habitat Loss and Long-term Channel Changes (Bank Stabilization, Rock Slope Protection, Gabion Baskets)

- The first choice of bank stabilization techniques will be "soft" bioengineering methods.
- Rock slope protection (riprap) will be used only as a last choice when bioengineering methods cannot provide adequate protection to infrastructures.
- Very large angular rock will be used to reduce chance of movement.
- LWD will be incorporated into the riprap.
- Willow cuttings will be staked through the riprap into the bank beneath.
- Riprap will be terraced and trees will be planted on the terraces.
- Soil will be imbedded into the interstitial spaces above ordinary high water (OHW) and planted with riparian vegetation.
- Where feasible, riprap will be designed with "hard points." Instead of a solid linear wall of riprap along a length of streambank, rock groins will be placed strategically in noncontiguous sections.

- An underlay of gravel, biodegradable filter fabric, or matting will be used when appropriate for riprap.
- Gabion baskets will only be used in areas at least eight ft above the toe of the channel and only in limited, steep areas (<1.5:1 slope) where alternative bank stabilization techniques would fail.

C. Administration of the RGP

The RGP will be implemented in a manner consistent with the process described below:

- For MPWMD-sponsored projects, MPWMD will be responsible for planning, design, environmental review, securing permits, construction management, restoration planting, irrigation system installation, monitoring, and project maintenance.

- In addition to MPWMD-sponsored restoration projects, MPWMD will also act as an agent for other publicly- and privately-sponsored projects that qualify for authorization under the RGP. MPWMD will assume the responsibility for screening applicants, conducting pre-project evaluations, and inspecting project sites after completion to ensure compliance with criteria outlined in the RGP. MPWMD will review proposed designs for conformance with existing standards. MPWMD will issue to each party proposing to do work a River Work Permit that requires compliance with Corps 404 permit conditions and MPWMD standards.

- Applicants seeking project permit authorization will provide to MPWMD a notification package containing information, maps, and plans, including but not limited to: a project description with date and duration of construction, an erosion control plan, a temporary streamflow diversion plan, description of impact minimization practices used during construction activities, a mitigation and monitoring plan, and the identification of listed species and life stages that may use the project area at any time.

- MPWMD will review the notification package for completeness, determine if the RGP is applicable to the proposed project, and send the notification package to the Corps.

- The Corps will forward the notification package to NOAA Fisheries with a cover letter requesting NOAA Fisheries' concurrence that the proposed project complies with this programmatic biological opinion.

- After receipt of written concurrence from NOAA Fisheries, the Corps will authorize implementation of the project. The Corps will notify NOAA Fisheries prior to authorization.

- If NOAA Fisheries does not respond within 60 days, it will be understood by the Corps and MPWMD that NOAA Fisheries approves the proposed package, and the proposed project will be included under this opinion.

- MPWMD will be responsible for the preparation of annual post-notification/compliance reports to be provided to NOAA Fisheries. These reports will contain:

  - Information on all projects constructed under the RGP for a given year;

  - MPWMD evaluation forms prepared for each project; and

  - Project specific information such as: (a) project descriptions, (b) project impacts, (c) maps, (d) pre- and post-construction photographs, (e) quantities and types of fill material, (f) salmonid life stages that may use the project area at any time, and (g) compliance with all permit conditions.

D. Action Area

The action area is defined as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For the RGP, the action area is defined as the lower 17.3 miles of the Carmel River downstream from the San Clemente Dam including the river channel and banks in Monterey County, California.

III. STATUS OF THE SPECIES

A. Species Description

This biological opinion analyzes the effects of the Carmel River Restoration and Maintenance RGP on threatened SCCC steelhead (*Oncorhynchus mykiss*) and their habitat. General information on species life history, biological requirements, population trends, and habitat descriptions is provided below. Further detailed information is available in the NOAA Fisheries Status Review of west coast steelhead from Washington, Idaho, Oregon, and California (Busby *et al.* 1996), the NOAA Fisheries proposed rule for listing steelhead (61 FR 41541), the NOAA Fisheries Status Review for Klamath Mountains Province Steelhead (Busby *et al.* 1994), and the NOAA Fisheries final rule listing the Southern California Coast steelhead ESU, SCCC steelhead ESU, and the Central California Coast steelhead ESU (62 FR 43937).

1. <u>Adult Freshwater Migration and Spawning</u>

Adult steelhead migrate from the ocean to freshwater rivers and streams to spawn. The most widespread run type of steelhead is the winter (ocean-maturing) steelhead that enter freshwater during late fall, winter, and early spring months with well-developed gonads and spawn shortly thereafter (Barnhart 1986). Summer (stream-maturing) steelhead that enter freshwater during summer and fall months (including spring and fall steelhead in southern Oregon and northern California) are less common. Summer steelhead enter freshwater in a sexually immature condition and require several months in freshwater to mature and spawn (Barnhart 1986).

There is a high degree of overlap in spawn timing between populations, regardless of run type. California steelhead generally spawn earlier than steelhead in northern areas. Both summer and winter steelhead in California generally begin spawning in December, whereas most populations in Washington begin spawning in February or March. Among inland steelhead populations, Columbia River populations from tributaries upstream of the Yakima River spawn later than most downstream populations. Only winter steelhead are found in the SCCC ESU.

The timing of upstream migration is correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures. Unusual stream temperatures during spawning migration periods can alter or delay migration timing, accelerate or retard mutations, and increase fish susceptibility to diseases. The minimum stream depth necessary for steelhead to successfully migrate upstream over a critical riffle is 18 cm (Thompson 1972). Reiser and Bjornn (1979) indicated that steelhead preferred a depth of 24 cm or more. Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986, Everest 1973).

Steelhead may spawn more than once before dying, in contrast to other species of the *Oncorhynchus* genus. It is relatively uncommon for steelhead populations north of Oregon to have repeat spawning, and more than two spawning migrations is rare. In Oregon and California, the frequency of two spawning migrations is higher, but more than two is unusual.

The relationship between anadromous and non-anadromous *O. mykiss,* including possibly residualized fish upstream from dams, is unclear but likely to be important.

2. Embryo Hatching and Survival

Reiser and Bjornn (1979) found that steelhead prefer gravels of 1.3 cm to 11.7 cm in diameter and flows of approximately 40-90 cm/second. The survival of embryos is reduced when fines of less than 6.4 millimeter (mm) comprise 20-25 percent of the substrate. Studies have shown a higher survival of embryos when intragravel velocities exceed 20 cm/hour (Coble 1961, Phillips and Campbell 1961). The number of days required for steelhead eggs to hatch varies from about 19 days at an average temperature of 60°F to about 80 days at an average of 42°F. Fry typically emerge from the gravel two to three weeks after hatching (Barnhart 1986).

3. Juvenile Rearing and Outmigration

After emergence, steelhead fry usually inhabit shallow water along perennial stream banks. Older fry establish territories that they defend. Streamside vegetation and cover are essential. Steelhead juveniles are usually associated with the bottom of the stream. In smaller California streams, the water levels may drop so low during the summer that pools are the only viable rearing habitat. No passage between pools can occur until river levels rise with the onset of the rainy season. Therefore, juvenile steelhead rearing in isolated summer pools are extremely vulnerable to disturbance or water quality impacts. Daytime temperatures in summer rearing pools may also be near lethal levels; riparian shading and the presence of sub-surface, cold water seeps are often essential to maintain pool temperatures at tolerable levels. In winter, juveniles become inactive and hide in any available cover, including gravel or woody debris.

The majority of steelhead in their first year of life occupy riffles, although some larger fish inhabit pools or deeper runs. Juvenile steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Water temperatures influence the growth rate, population density, swimming ability, ability to capture and metabolize food, and ability to withstand disease of these rearing juveniles. Rearing steelhead juveniles prefer water temperatures of 45° to 58° F and have an upper lethal limit of 75° F.

Dissolved oxygen (DO) levels of 6.5 to 7.0 milligrams per liter (mg/L) affected the migration and swimming performance of steelhead juveniles at all temperatures (Davis *et al.* 1963). Reiser and Bjornn (1979) recommended that DO concentrations remain at or near saturation levels with temporary reductions no lower than 5.0 mg/L for successful rearing of juvenile steelhead. Low DO levels decrease the rate of metabolism, swimming speed, growth rate, food consumption rate, and efficiency of food utilization, and affect normal behaviors, ultimately reducing the survival rate of the juveniles.

During rearing, suspended and deposited fine sediments can directly affect salmonids by abrading and clogging gills, and indirectly cause reduced feeding, avoidance reactions, destruction of food supplies, reduced egg and alevin survival, and modified rearing habitat (Reiser and Bjornn 1979). Bell (1973) found that silt loads of less than 25 mg/L permit good rearing conditions for juvenile salmonids.

Juvenile steelhead live in freshwater between one and four years (usually one to two years in the Pacific Southwest) and then become smolts and migrate to the sea from November through May with peaks in March, April, and May. The smolts can range from 14 to 27 cm in length. Fish size appears to be positively correlated with water velocity and depth (Everest and Chapman 1972, Chapman and Bjornn 1969).

4. <u>Ocean Migration</u>

Steelhead spend between one and four years in the ocean (usually two years in the Pacific Southwest) (Barnhart 1986). The distribution of steelhead in the ocean is not well known. Tagging studies indicate that most steelhead tend to migrate north and south along the Continental Shelf (Barnhart 1986). Steelhead stocks from the Klamath and Rogue Rivers probably mix together in a nearshore ocean staging area along northern California before they migrate upriver (Everest 1973).

B. Range-Wide (ESU) Status and Trends of Species

The Carmel River watershed is located within the boundaries of the SCCC steelhead ESU for steelhead, which are Federally listed as threatened (NOAA Fisheries 1998). Steelhead are present throughout the action area in the Carmel River.

Assessments of steelhead abundance within this ESU show a substantial decline during the past thirty years (McEwan and Jackson 1996, Nehlsen *et al.* 1991, Snider 1983, CDFG 1965). In the mid-1960s, total spawning populations of steelhead in the rivers in this ESU were estimated as 17,750 (CDFG 1965). Other estimates of steelhead for individual rivers in this ESU include 1,000 to 2,000 in the Pajaro River in the early 1960s (McEwan and Jackson 1996), and about 3,200 steelhead in the Carmel River for the 1964-1975 period (Snider 1983). Recent estimates for the Pajaro, Salinas, Carmel, Little Sur, and Big Sur Rivers indicate runs of fewer than 500 adults where previously runs had been on the order of 4,750 adults (Busby *et al.* 1996). Adult escapement data for the Carmel River above San Clemente Dam shows a significant decline of 22 percent per year from 1963 to 1993, with a five-year total count of only 16 adult steelhead at the dam between 1988-1992. Nehlsen *et al.* (1991) identified five stocks within the ESU at varying risks of extinction: the Pajaro River and Carmel River at high risk, the Salinas River at moderate risk, and the Big Sur River and the Little Sur River at levels of special concern.

Factors contributing to steelhead decline throughout the ESU include agriculture and urban land use, flood control activities, and the construction and operation of major dams for both streamflow regulation and water use. These factors have resulted in loss or modification of instream and riparian habitats, partial and complete barriers to upstream rearing and spawning habitats, and lack of flows for steelhead migration, spawning, and rearing.

Since 1994, the Carmel River stock has partially recovered with a recent seven-year average (1997-2003) of 636 fish passing the ladder at San Clemente Dam. Improved climate conditions, captive brood stock efforts, and ongoing rescue and relocation efforts likely contributed to the increase. Little information on total run sizes or trends in steelhead abundance is available for other watersheds within the ESU.

C. Existing Likelihood of Survival and Recovery

Total steelhead abundance is extremely low and most stocks in the ESU, for which there are data, show a substantial decline during the past thirty years (Busby *et al.* 1996). Their decline has been attributed to long-standing human-induced factors (*e.g.*, blocked access to historic spawning and rearing areas upstream of dams, extensive water diversions) that exacerbate the adverse effects of natural environmental variability (61 FR 56138, 62 FR 43937, Titus *et al.* 1999). This species is generally more resilient to perturbation than other salmonids due to their ability to tolerate a wider range of habitat conditions. However, the poor condition of their habitat and low abundance in many areas remains a serious risk to their survival and recovery. Furthermore, with the exception of the Carmel River, steelhead distribution through the ESU is very patchy and uneven. As noted above, the Carmel River run has shown a partial recovery and is larger than many of the other major watersheds combined.

IV. ENVIRONMENTAL BASELINE

A. Overview of the Carmel River Watershed

The action area is located in the Carmel River watershed, a 255 square-mile watershed in the Santa Lucia Mountain range along the central coast of California. The Carmel River is a mid-size drainage when compared to the Salinas and Pajaro Rivers, also within the SCCC ESU, but larger than the streams located along the Big Sur Coast and San Luis Obispo Coast south of the Monterey Bay area. In the upper watershed, the river and its tributaries flow in deep, steep-sided canyons. For its last 15 miles, the river flows across the relatively flat Carmel Valley floor to the Pacific Ocean. Two operating dams are located on the Carmel River: San Clemente Dam is located near the confluence of Carmel River and San Clemente Creek at about RM 18.5, and Los Padres Dam is located at about RM 23.5. Major tributaries include Garzas Creek and Tularcitos Creek below San Clemente Dam, and San Clemente Creek, Pine Creek, and Cachagua Creek between San Clemente Dam and Los Padres Dam (Duffy 1998).

Over 90 percent of the average annual precipitation within the Carmel River watershed occurs between November and April, with January and February being the wettest months. In the rainy season, runoff from the upper watershed refills the Los Padres Reservoir, which is usually lowered during the preceding warm, dry summer months. San Clemente Reservoir remains full year round. After the reservoir is filled, water overflows to the lower mainstem (Duffy 1998). Because of water withdrawals from the aquifer underlying the river, flow in the lower mainstem of the river does not reach the lagoon at the mouth of the river until substantial fall or winter rains have raised river levels and recharged the aquifer. Sustained flows of approximately 400 cubic ft per second (cfs) past the dams for several days are necessary before the aquifer is recharged to the point where flows in the lower mainstem reach the Lagoon. The Carmel River Lagoon is a naturally occurring lagoon and wetlands area located at the mouth of the Carmel River, where the river flows to the Pacific Ocean at Carmel Bay.

B. Factors Affecting Habitat Conditions in the Carmel River Watershed and Action Area

Habitat for freshwater rearing and spawning of steelhead in the Carmel River watershed, including the action area, is affected by a number of factors. Land use activities associated with road construction, urban development, agriculture, water development projects, and recreation have significantly altered habitat quantity and quality through: alteration of streambank and channel morphology, alteration of ambient stream water temperatures, degradation of water quality, elimination of spawning and rearing habitat, fragmentation of available habitats, elimination of downstream recruitment of gravel and LWD, and removal of riparian vegetation resulting in increased streambank erosion. Agricultural practices and urban encroachment on the floodplain have eliminated large trees and logs and other woody debris that would have been otherwise recruited to the stream channel. LWD influences stream morphology by affecting pool formation, channel pattern and position, and channel geometry. These factors are discussed in detail below.

1. Dams

The California-American Water Company (Cal-Am) owns three dams on the main stem of the Carmel River: San Clemente Dam, Los Padres Dam, and the Old Carmel River Dam (OCRD). San Clemente Dam is located near the confluence of Carmel River and San Clemente Creek (RM 18.6), is 85 ft high, and was completed in 1921. Los Padres Dam, completed in 1949, is 148 ft high and is located about six miles upstream of San Clemente Dam (RM 24.6). A fish ladder on the south side of San Clemente Dam was constructed when the dam was built. At Los Padres, a trap and truck operation is used to pass fish over the dam. Presently, excessive sedimentation from natural events, such as the Marble Cone and Kirk Complex fires, and man-made sources has reduced the capacity of the Los Padres Reservoir from 3,030 acre-ft (AF) in 1949 to an estimated 1,569 AF in 1998 (MPWMD 2004) and San Clemente Reservoir from 1,425 AF in 1921 to less than 150 AF (Duffy 1998).

Operations of both dams are coordinated to regulate streamflow and to supply water to users in the Carmel Valley and on the Monterey Peninsula via the Carmel Valley Filter Plant. The two dams are operated by Cal-Am in accordance with quarterly water supply budgets developed in cooperation with the MPWMD and CDFG under a Memorandum of Agreement (MOA). The MOA is designed to maximize releases from San Clemente Reservoir to maintain rearing habitat for juvenile steelhead in the river downstream. In general, Los Padres Dam is operated by Cal-Am to maintain as much water as possible in the reservoir and to maintain a minimum streamflow requirement of five cfs below Los Padres Dam throughout the July through December period.

Approximately 0.5 miles downstream of San Clemente Dam is the OCRD, which was completed in 1883 by the Pacific Improvement Company to provide sufficient water to support the Del Monte Hotel and the Los Laureles Rancho. This dam no longer operates as a water diversion facility and causes problems with adult fish passage during upstream migration periods. Adults have difficulty finding the entrance to the ladder, move upstream past the entrance, and attempt to jump the dam, often injuring themselves in the effort. During years when flow conditions make it difficult to find the ladder entrance, a higher proportion of fish with injuries to the snout and head arrive at Los Padres Dam. The dam is also about three ft thick at the crest, which creates an area of high velocity over the top of the dam that fish must immediately accelerate through upon completing their jump. This combination of factors makes fish passage at this facility problematic (Entrix 2000). A notch has been cut in the dam to allow easier passage for steelhead at lower flows.

The three dams on the Carmel River delay and restrict passage for upstream migrating adults and downstream migrating juveniles, smolts, and kelts. This has resulted in lower steelhead abundance and productivity in the upper watershed. Densities of steelhead rearing above Los Padres Reservoir were assessed by Kelley (1983) to be one third that of comparable sized streams. The reservoirs behind the dams also contribute to increased water temperatures downstream, which have been recorded as near lethal limits for steelhead (MPWMD 1999).

2. River Channel Morphology

After completion of San Clemente Dam in 1921, the channel downstream of the dam began a process of incision and armoring as a result of the lack of bedload in flows from San Clemente Reservoir. Armoring is common downstream of dams as fine riverbed materials are washed downstream without a source of replacement, leaving only coarse materials that prevent further erosion of the riverbed (except during the largest floods). The process of incision and armoring continued until about 1940, when a new dynamic equilibrium was established. After completion of the Los Padres Dam in 1949, this process was repeated in the reach between the two dams but on a smaller scale due to the presence of bedrock controls and the limited amount of alluvial material in the channel. This incision increased the depth and speed of water flow and the rate of bank erosion, although erosion was limited by the growth of riparian vegetation along the newly cut banks (Jones and Stokes 1998). In some reaches of the river, the channel deepened by up to 13 ft. As a result of the incised channel, flooding on the floodplains decreased. This allowed residential and commercial properties to develop in the floodplain. Numerous golf courses and private residences are now built along the Carmel River.

The change in river channel morphology and armoring of the channel has eliminated spawning gravels for a distance of approximately two miles below San Clemente Dam. The lack of gravels in this section of the river also has changed and eliminated riffles, important in the production of prey sources for rearing steelhead. The increased development of the floodplain has created a much greater emphasis on flood protection and preventing erosion of banks, resulting in the placement of hard structures such as bare riprap, concrete rubble, cement walls, and cars, *et cetera*, along about 40 percent of the lower river. The use of these hard structures has significantly degraded the habitat value of much of the lower 18 miles of river.

3. Water Withdrawals from the Underflow of the Carmel River

A number of wells, which pump water from the underflow of the Carmel River, are located downstream of the two dams. Cal-Am operates 21 of these wells and is the largest holder of a water right on the river. Cal-Am has a legal water right for 3,376 AF and diverts an additional 10,730 AF from the Carmel River. Under State Water Resources Control Board (SWRCB) Order 95-10, as amended, Cal-Am's additional diversion of 10,730 AF is legal so long as Cal-Am complies with the directive of SWRCB Order 95-10, as amended, which orders Cal-Am to find an alternate source for the additional 10,730 AF. Additional wells are operated privately under much smaller water rights. Of these additional wells, the State Division of Water Rights has identified 14 major diverters which cumulatively divert up to 1,729 acre-ft annually from the underflow of the Carmel River. As a result of these withdrawals, the Carmel River goes dry downstream of the Narrows (RM 9.5), usually by July of each year. From July until the rains begin, the only water remaining in the lower river is in isolated pools that gradually dry up as the groundwater table declines with continued withdrawals. Similarly, surface flow into the lagoon normally recedes in late spring and ceases in summer as rates of water extraction from the river and alluvial aquifer exceed baseflow discharge (Duffy 1998).

The cumulative effects of the water withdrawals and the resulting drying up of half of the lower river reduce the steelhead rearing capacity of the lower river from approximately 138,000 (Kelley 1983) to 70,000 (MPWMD 2001). The lowered groundwater tables and drying of the lower river also diminish the window of time available for migration of adults in the fall and winter and outmigration by smolts in the spring and summer. Substantial rainfall is needed to recharge the aquifer before surface flows reach the ocean. In the drought years of 1987 to 1992, the river failed to reach the ocean for four years. Reduced surface flows and lowered groundwater tables also create poor water quality conditions and lowered water levels in the Carmel River Lagoon, which result in reduced growth and mortality of rearing fish.

In 1990, MPWMD certified the Water Allocation Program Final Environmental Impact Report which set water allocation limits for annual Cal-Am water production (Jones and Stokes 1998). A mitigation program was included to mitigate for significant environmental impacts from Cal-Am's diversions. This mitigation plan provides for: expansion of the program to capture and transport smolts during spring, prevention of stranding of early fall and winter juvenile migrants, rescuing of juveniles downstream of Robles del Rio during summer, and implementation of an experimental smolt transport program at Los Padres Dam (1998-99 Annual Report, MPWMD 1999).

Under this program, the Sleepy Hollow Steelhead Rearing Facility was constructed in 1997 to hold and rear juveniles, which are rescued during the summer months when the lower reaches of the river become dry. During the summer of 1999, two power outages and an undetected attack of red-headed mergansers resulted in the mortality of most of the juvenile steelhead rescued during the summer (approximately 1,000 fish). Additionally, water temperatures at the facility during the summer months are too warm for steelhead rearing and result in high mortality rates due to temperature-related disease problems. A water-cooling tower has been built to alleviate this problem. During the summer of 2001, a majority of rearing fish were lost to larger trout having entered the facility from the river. In 2002, the facility was inoperable due to problems with the water supply pumps.

4. Loss of Riparian Vegetation

In the mid- and late 1970s, a considerable amount of riparian vegetation was lost as the 1976-1977 drought and increased groundwater pumping lowered the water table in parts of the Carmel Valley. With the banks unprotected by riparian vegetation, the river adjusted to subsequent floodflows by eroding both the channel bed and the banks. As a result of this process, a middle reach of the river between the Garland Ranch Regional Park and Schulte Road, changed drastically from a narrow, deep, meandering channel with well-developed riffles and pools to a wide, shallow channel with eroded banks and an unstable bed. Floodflows in 1995 and 1998, which were the highest since the USGS began recording flows at Robles del Rio in 1958, widened many portions of the river between Schulte Road and Highway 1 (Jones and Stokes 1998).

The lowered ground water levels from excessive water withdrawal and the subsequent die-off of riparian vegetation also contributed to bank erosion and destabilization of the river channel. This has endangered riverside properties that were developed after the river incised. Before 1984, property owners took action individually to prevent bank erosion and property loss. Many different types of protective works were installed, including native fill, levees, gabion baskets, car bodies, used appliances, tires, jacks, sheet pilings, rock riprap, concrete rubble, concrete blocks, "sackcrete" (wetted-down sacks of cement), masonry bricks, and large posts with gabion wire (Jones and Stokes 1998). Multiple sites along the length of the Carmel River have been hardened for bank protection, resulting in a loss of habitat for steelhead.

Since 1980, the MPWMD has monitored the health of the Carmel River riparian corridor closely. The Riparian Corridor Management Program, which is mitigation for the Water Allocation Program, integrates MPWMD's many riparian mitigation and management activities into one program. The goal of this plan is the rehabilitation, restoration, enhancement, and preservation of the streamside corridor along the Carmel River (1998-99 Annual Report, MPWMD 1999). Mitigation measures include erosion control, revegetation, irrigation, and channel clearing. The channel clearing, intended to increase flood flow capacity and diminish scour of banks and levees, reduces the habitat value of the stream corridor by removing important aspects of instream cover and habitat-forming downed trees.

C. Status of the Species in the Carmel River and Action Area

The California Advisory Committee on Salmon and Steelhead (CACSS 1988) cited an estimate of 20,000 steelhead in the Carmel River in 1928. Although CDFG (1965) estimated 27,750 steelhead spawning in many rivers of this ESU in the mid-1960s, McEwan and Jackson (1996) reported runs ranging from 1,000 to 2,000 in the Pajaro River in the early 1960s, and Snider (1983) estimated annual escapement of about 3,200 steelhead for the Carmel River for the 1964-75 period (Busby *et al.* 1996). Compared to any other single stream in this ESU, the Carmel River presently maintains the largest adult run.

Presently there is no hatchery production within this ESU. There were small private and cooperative programs producing steelhead within this ESU, as well as one captive broodstock program intended to conserve the Carmel River steelhead strain (McEwan and Jackson 1996). Most hatchery stocks used in this region originated from stocks indigenous to the ESU, but many were not native to their local river basins (Bryant 1994). Little information exists on the actual contribution of hatchery fish to natural spawning.

A combination of ladder counts, spawning redd surveys, and angler surveys estimate that, in the absence of angling, about one half (55 percent) of the adults that enter the Carmel River move upstream of the San Clemente Dam (Dettman and Kelly 1986). An estimate of the total steelhead run in the Carmel River in 1984 was 860 adults (Jones and Stokes 1998). Between 1987 and 1991, a drought occurred in the region and no outflow through the river mouth occurred in 1988, 1989, and 1990. No steelhead entered the system during these four years. Recently, the steelhead population has begun to recover from the effects of the 1987-1991 drought. The 1997 and 1998 totals were the highest counts at San Clemente Dam since 1975 (775 and 861, respectively; Jones and Stokes 1998). From 1999-2002, steelhead adults returning to the San Clemente Dam numbered 409, 477 (Entrix 2000), 804 (MPWMD 2001), and 642, respectively. Ladder counts recorded 483 adults in the 2002-2003 season.

V. EFFECTS OF THE ACTION

Effects to listed steelhead and their habitat caused by activities associated with this project will depend upon the amount, scope, and specific locations of potential projects. In addition, emergencies, such as floods or severe storms, would significantly influence the activities proposed in the future. The following general categories of activities that could create adverse effects to listed steelhead and habitat during project construction activities were identified by NOAA Fisheries during consultation:

- Harassment or death due to dewatering or water diversions;
- Impediment to upstream or downstream migration by listed steelhead during water diversion/bypass construction activities;
- Harrassment or death due to toxics, metals, and/or petroleum products from machinery;
- Degradation of water quality and/or channel structure from turbidity or sediment plumes;
- Loss of riparian vegetation due to construction;
- Harassment or loss of habitat from in-water construction activities;
- Habitat degradation from construction access and temporary stream crossings;
- Loss of LWD and in-channel vegetation from channel clearing;
- Habitat degradation from sand and gravel bar excavation; and
- Bank hardening and associated habitat loss and long-term channel changes (*e.g.*, bank stabilization, rock slope protection).

Most projects would likely occur in degraded areas; none are expected in areas with pristine conditions. In many cases, degraded areas of the river exhibit three characteristics: little or no riparian vegetation, unstable (steep) streambanks, and braided channels with large mid-stream gravel bars. As such, the amount of riparian and instream vegetation adversely affected by the project will be considerably less than if completed in pristine areas. All projects also are expected to result in beneficial effects to threatened steelhead and the aquatic habitats on which they depend. Only actions consistent with the minimization measures provided in the project description section of this opinion shall be covered under this programmatic biological opinion.

A. Adverse Effects to Threatened Steelhead

1. Harassment or Death Due to Dewatering or Water Diversions

Stream flow diversions could adversely affect individual steelhead by concentrating or stranding them in residual wetted areas (Cushman 1985) or causing them to move to adjacent habitats with poor habitat conditions that decrease their fitness (Clothier 1953, Clothier 1954, Kraft 1972, Campbell and Scott 1984). Dewatering the workspace may injure or kill steelhead by temporarily confining them to areas predisposed to dewatering or desiccation, increased water temperature, decreased dissolved oxygen concentration, and predation (Cushman 1985).

Dewatering and diversions implemented under the RGP will occur only between July 1 and October 31 of any year, with the dewatering and/or diversion being completely removed by October 31. This timing avoids the migration and spawning season for steelhead migration. Therefore, adverse effects to steelhead adults, migration corridors, or spawning habitat are not expected to occur. Rearing juveniles likely will be present.

Prior to dewatering, juvenile fish will be rescued and relocated out of the construction area. Juveniles that are relocated for project implementation could be stunned or injured from capture and stressed from handling between the capture site and relocation site. Any fish collection gear, whether passive (Hubert 1983) or active (Hayes 1983), has some associated risk to the fish, including stress, disease transmission, injury, or death. The applicant proposes to relocate fish from the areas to be dewatered by stunning them with backpack electroshockers, netting them, placing the fish in insulated, oxygenated tanks filled with Carmel River water, and moving them to adjacent suitable habitat or the Sleepy Hollow facility.

Electrofishing can kill both juvenile and adult fish (Reynolds 1983, Zeigenfuss 1995, Habera *et al.* 1999, Nordwall 1999). The amount of unintentional mortality attributable to electroshocking may vary widely depending on the equipment used, the settings on the equipment, ambient conditions, and the expertise and experience of the personnel. The effects to fish from electroshocking can be severe, and may include death, spinal injuries, burns, hemorrhaging, and physiological stress. Sharber and Carothers (1988) reported that electroshocking caused a 50-percent mortality level in adult rainbow trout. Habera *et al.* (1996) reported overall mortality rates of 20 percent for rainbow trout less than 100 mm in length and six percent for those more than 100 mm using a three-pass depletion method. Habera *et al.* (1996) also reported an overall injury rate of six percent. Long-term effects of electroshocking on both juveniles and adult salmonids are not well understood; although chronic effects may occur, it is assumed that most impacts from electroshocking occur at the time of sampling.

With implementation of protocols used in capturing fish for relocation, unintentional mortality of listed juvenile steelhead expected from capture and handling procedures is not likely to exceed six percent (Ambrose and Hines 1998, Habera *et al.* 1996) of the fish handled, and may be reduced to approximately one percent with increased skill and experience of the fish relocation personnel. MPWMD personnel are highly experienced at capturing and relocating juvenile steelhead. As such, mortality is expected to be no more than one to two percent of captured and handled fish.

Mortality of SCCC steelhead due to capture and relocation and is dependent upon the number and types of projects carried out annually. The RGP limits MPWMD maintenance and restoration projects to 2,640 linear ft and privately-sponsored projects to 1,000 linear ft. Fisheries enhancement projects are unlimited spatially within the 17.3 mile project area. Except for critical riffle modification and LWD installation, enhancement projects will be completed in the dry stream channel only and, therefore, will not require fish relocation. Critical riffle modification is limited to 600 lineal ft per year, and LWD installation is limited to 500 lineal ft per year. MPWMD conducts surveys of rearing juveniles during October of each year and has documented average juvenile densities of 0.86-1.16 fish/linear ft. RGP activities will occur between July 1 and October 31 of each year. Accounting for natural summer mortalities, densities likely will be higher when RGP activities occur (July-August). As such, MPWMD estimates summer densities of approximately 1.5 fish/linear ft. Assuming a fish density of 1.5 fish/linear ft, 4,740 ft of dewatering/relocation completed per year, and a handling mortality of two percent, RGP activities could result in capture and relocation of 7,110 juvenile steelhead and mortality to approximately 142 juvenile steelhead per year (1.5 fish/ft * 4,740 ft = 7,110 fish; 7,110 fish * 0.02 = 142).

2. Impediment to Upstream or Downstream Migration During Water Diversion/Bypass Construction Activities

As discussed under *Status of the Species*, adult steelhead migrate upstream to spawning areas and downstream to the ocean after spawning, and juvenile steelhead migrate both upstream and downstream throughout the year to utilize more favorable habitat or to travel to the ocean during spring as smolts. Loss of passage results in delayed completion or termination of behavioral or life history patterns required for the survival of listed steelhead.

The RGP only allows construction between July 1 and October 31 of each year with all diversions removed by October 31. Diversions implemented during this time period will not result in impediments to adults or smolts, because it is outside of the migration season for adult and smolt SCCC steelhead. Diversions likely will impede migration of juveniles for up to 4.5 months. During this time period, the lower nine miles of the action area typically goes dry. Steelhead juveniles are rescued from this area yearly as the river begins to dry back. Any projects within the lower nine miles are expected to be implemented after dryback and rescues have occurred. As such, diversions and/or bypasses likely will not be needed. Upstream of RM 9, flow persists, and rearing habitat is available throughout the summer and fall. An impediment of up to 4.5 months is not expected to cause injury or mortality to juveniles in this upper area, because rearing habitat is expected to be available to them both upstream and downstream of any project diversions.

3. Harrassment or Death due to Toxics, Metals, and/or Petroleum Products from Machinery

Oils and similar substances from construction equipment can contain a wide variety of polynuclear aromatic hydrocarbons (PAHs) and metals. Both can result in adverse impacts to salmonids. PAHs can alter salmonid egg hatching rates and reduce egg survival as well as harm the benthic organisms that are a salmonid food source (Eisler 2000). Some of the effects metals can have on salmonids are: immobilization and impaired locomotion, reduced growth, reduced reproduction, genetic damage, tumors and lesions, developmental abnormalities, behavior changes (avoidance), and impairment of olfactory and brain functions (Eisler 2000). Toxic substances from construction equipment may be released into the dry stream bed and then mobilized in late fall or winter during the first heavy rains.

Minimization measures included in the project description are expected to avoid and minimize the occurrence and/or amount of toxic substances entering the stream bed. No eggs or alevins are expected to be present during the time that machinery is used, and no toxics are expected to be released into flowing water. Should substances be released into the dry stream bed, only juveniles directly downstream of the construction area could be affected, and rains and flows are expected to quickly dilute any toxic chemicals present so that the chance of injury is minimal. As such, exposure to toxic products from activities authorized under the RGP is not expected to result in injury or mortality of SCCC steelhead.

4. Degradation of Water Quality and/or Channel Structure from Turbidity and Sedimentation

Adverse effects on water quality may occur due to bank disturbance, loss of riparian habitat, increases in water temperature or biological oxygen demand from losses in riparian cover or changes in channel morphology, and/or increases in fine sediments. Water quality degradation may: affect the ability of fish to feed, block or delay juvenile or adult steelhead migration, cause juvenile steelhead to move into areas of higher predator density, and/or cause short- or long-term physiological damage that ultimately prevents a listed steelhead from successfully reproducing.

a. Turbidity

Turbidity refers to the amount of light scattered or absorbed by a fluid. Elevated levels of turbidity may result when fine sediment is contributed to the river or mobilized during construction. Turbidity due to suspended sediment is likely low in the river throughout most of a given year. Suspended sediment produces little or no direct mortality on adult fish at levels observed in natural, relatively unpolluted streams (Waters 1995). High concentrations of suspended sediment can result in direct mortality (Lloyd 1987, Sigler *et al.* 1984, McLeay *et al.* 1984, McLeay *et al.* 1983) or deleterious sublethal effects to fish, including reduced feeding efficiency and decreased food availability (Velagic 1995, Gregory and Northcote 1993, Reynolds *et al.* 1989, Berg and Northcote 1985, Newcomb and Flagg 1983, Bisson and Bilby 1982, Herbert and Merken 1961, Cleary 1956).

Cedarholm and Reid (1987) observed evidence of stress in juvenile coho salmon exposed to suspended sediment levels from 1,000 to 12,000 mg/L. Temporary visual impairment, caused by the suspended sediments, reduced the ability of the salmon to capture prey (Berg 1982). Redding *et al.* (1987) reported physiological changes indicative of stress in coho salmon and steelhead exposed to sublethal levels of suspended sediments. Studies on adult and juvenile salmon have shown that salmon, when exposed to short-term pulses of suspended sediments, dispersed from or avoided the area (Bisson and Bilby 1982, Whitman *et al.* 1982, Berg and Northcote 1985).

The duration and concentration of the turbidity would depend partially on the length of time required to construct the proposed project and the volume and rate that sediment is contributed to the creek, or mobilized, during construction activities. For all projects, MPWMD proposes to isolate the workspace from flowing water, install erosion control devices at the time of the proposed action, and detain sediment laden water on-site. Thus, while turbidity levels may increase over background levels, the increase is likely to be temporary and minor with no detectable effects to steelhead.

b. Sedimentation

Construction operations frequently disturb and expose soil. The major impact to steelhead from disturbing and exposing soil is the production of excess fine sediment. Many construction activities remove vegetation and disrupt the structure of the soil surface, leaving the soil susceptible to rainfall and runoff erosion, channel erosion, and wind erosion. Construction often results in disturbed streambanks and channels. Once vegetation or other bank protection materials are disturbed, flows may begin to erode the unprotected soil. Although streambank erosion is a fluvial process that may recruit spawning gravels and bedload into stream channels, the rate and size distribution of materials being recruited can be in excess of what the hydraulics of the stream can move to form channel structure. This can create a self-perpetuating cycle of increased recruitment and loss of structure. Consequently, it is necessary to consider the long-term downstream effects of sediment inputs.

Water quality and habitat structure and quality can be adversely affected by excess sedimentation, leading to a series of channel and habitat responses and ultimately affecting steelhead production by increasing their energetic demands and susceptibility to disease and predation. Substantial sedimentation rates could bury less mobile organisms that serve as a food source for many fish species (Ellis 1936, Cordone and Kelley 1961), degrade instream habitat conditions (Cordone and Kelly 1961, Eaglin and Hubert 1993), infiltrate redds resulting in progressively lower egg survival (Tappel and Bjornn 1983, McNeil and Ahnell 1964, Reiser and White 1988, Tagart 1984), and cause reductions in fish abundance (Alexander and Hansen 1986, Berkman and Rabeni 1987) and growth (Crouse *et al.* 1991). Siltation may reduce habitat diversity by filling pool habitat, thereby reducing juvenile habitat and adult holding habitat. Deposited fine sediment can reduce the amount of spawning habitat. Silt may clog spawning gravels, thereby reducing water flow through the gravel and reducing the interstitial dissolved oxygen concentrations. Low dissolved oxygen concentrations may kill eggs and fry. If eggs and fry are not killed, reduced interstitial oxygen concentrations may cause longer incubation periods, higher rates of deformity, and smaller, weaker fry. Siltation may also prevent fry from emerging from the gravel.

Construction projects can cause temporary increases in sedimentation downstream. Projects covered under this opinion will implement avoidance/minimization measures described in the *Project Description* to reduce the input of sediment into the stream. For all projects, MPWMD proposes to isolate the workspace from flowing water, to install erosion control devices at the time of the proposed action, and to detain sediment laden water on-site. Thus, while some sedimentation may result from construction of water diversions and access points, increases are expected to be minimal, temporary, and localized with no long-term degradation of habitat or measurable effects to steelhead.

5. Loss of Riparian Vegetation

Riparian vegetation borders a stream and is an integral part of the habitat for listed steelhead. The functional values of riparian corridors and the benefits they provide to aquatic systems overall, and stream fish populations in particular, are well documented (Hall and Lantz 1969, Karr and Schlosser 1978, Lowrance *et al.* 1985, Wesche *et al.* 1987, Gregory *et al.* 1991, Platts 1991, Welsch 1991, Castelle *et al.* 1994, Lowrance *et al.* 1995, Wang *et al.* 1997).

Loss of riparian habitat may lead to changes in water quality. The removal of shading and increase in solar input may increase water temperatures and/or produce large amounts of algae. As algae dies, biological oxygen demand increases and dissolved oxygen concentrations decrease, reducing water quality. In addition, the loss of riparian vegetation may reduce the amount of energy stored in organic material that serves as food for aquatic invertebrates entering the stream ecosystem, leading to a decrease in aquatic invertebrates. Many of the potentially affected aquatic invertebrates are forage for steelhead. Reduced forage can result in reduced growth rates of steelhead and increased competition for available forage, thus reducing size and fitness and decreasing abundance of steelhead.

Effects on habitat from removal of riparian vegetation can include: wider, shallower, less complex channels; increases in water temperatures; reduction in the amount of energy input from leaf fall; stimulation of algal growth by increasing the amount of light; reduction in the prey base for juvenile steelhead; reduction in habitat diversity by reducing the input of woody debris; and, an increase in sediment and pollutant chemical input into steelhead habitat. All of the above effects may result in reduced steelhead carrying capacity and production.

Typical revegetation efforts would result in post-project health, density, and diversity of vegetation that would likely be greater than pre-project. While it likely will take three to ten years for vegetation to mature and provide significant shade and cover, any benefits provided in the interim are expected to be equal to or greater than what would be present without project implementation. This is because projects are expected to occur in areas with very degraded riparian vegetation conditions, and because current ground and surface water levels are not expected to support natural re-establishment of vegetation.

The magnitude of riparian vegetation loss due to construction will vary depending on the number of projects and the location of project sites. As discussed above, most projects will occur in areas that are highly disturbed from erosion or lack of water. Most mature riparian vegetation that would be removed exists in sparse, unevenly distributed, and discontinuous stands, and has little influence on channel form, function, shade, cover, or bank stability. Pursuant to minimization and avoidance measures described in the *Project Description*, all native vegetation present will be retained to the maximum extent practicable and disturbance will be minimized. Areas of disturbance will be vegetated with seed cover and plantings at a minimum 3:1 ratio. Project proponents will ensure that seedings and plantings have a 70 percent survival. As a result, no detectable adverse effects to steelhead are expected to result from loss of riparian vegetation. Rather, project activities are expected to improve riparian habitat conditions over the long term.

6. Harrassment and/or Loss of Habitat from Construction Access and Temporary Crossings

Construction access and temporary stream crossings could adversely affect steelhead and/or habitat from: temporary increases in sedimentation, removal of riparian vegetation (both discussed above), constriction of channels resulting in higher velocities, interference to steelhead migration, or obstruction of flood flows causing washouts and reduced spawning and rearing habitat.

For all projects authorized under the RGP, crossings may be in place only between July 1 and October 31 of any year. Access and temporary stream crossing locations will be restored to pre-project conditions, and no crossing will be left in place after October 31. Furthermore, all temporary crossings shall pass all steelhead in the stream concurrent with the crossing. These measures avoid adult steelhead migration and spawning and high flood flows. Rearing juvenile steelhead could be in the vicinity of crossings during this time, but should be able to move out of the way of crossing installation. Once the crossing is installed, fish will be able to move freely about the location. As such, impacts are expected to be localized, temporary, and minor with no detectable effects to steelhead.

7. Loss of LWD and In-Channel Vegetation from Channel Clearing

In-channel vegetation and LWD play an integral part in channel form (*e.g.*, pool-riffle sequences) and function for steelhead. In-channel vegetation traps sediment deposits and helps to form riffles, pools, and meanders. LWD is commonly produced from riparian areas and is important in many stream ecosystems for stabilizing channel form, storing and metering sediments during sediment routing, and modulating flow hydraulics during various flows, *i.e.*, dissipating kinetic energy. Steelhead production in rearing habitats is increased when an abundance of escape cover (*e.g.*, hiding spots provided by water depth, vegetation, LWD, interstitial spaces in substrate, undercut banks) exists along with forage stations (places of very low water velocity next to threads of higher water velocity in which aquatic invertebrates are entrained). Normally, pool-riffle sequences are integral to this composition. Pools provide depth, cover, and still water, and riffles provide forage and increase oxygenation of water. Pool tails are commonly spawning beds for most steelhead. Adults also require deep pools as holding habitat during their upstream migrations.

Effects on steelhead and habitat from removal of in-channel vegetation and LWD can include: a change to a less complex channel, reduction in the prey base for juvenile steelhead, reduction in habitat diversity by reducing LWD, and reduction in the amount of vegetative matter as a food source for steelhead prey.

The magnitude of in-channel vegetation and LWD loss due to channel clearing activities will vary depending on the number and type of activities and the location of projects completed under each year of the RGP. The RGP limits MPWMD-sponsored work to 2,640 linear ft of stream and private work to less than 1,000 linear ft of stream per year. However, habitat enhancement projects, which have no spatial limitations, could also result in some loss of in-channel vegetation. For all projects, only vegetation and LWD that pose a hazard to public facilities will be disturbed, and only material that threatens bank stability will be removed. Mature vegetation and LWD may be trimmed or mechanically removed for erosion prevention. Only vegetation larger than three inches in diameter will be removed from the channel and removal will be done using hand tools. All vegetation within the channel that is smaller than three inches in diameter will be left in place. Vegetation extending more than 15 ft from the toe of the active channel towards the center of the channel will be trimmed, but left in place. LWD in the active channel that is deemed a hazard by MPWMD will be anchored by appropriate means or cut or notched into lengths of 20-25 ft and left in place to the greatest extent feasible.

The goal of these measures is to maintain as much vegetation and LWD in the channel as possible. By leaving vegetation less than three inches in diameter, trimming rather than removing vegetation from the banks, and disturbing only that vegetation and LWD that poses a hazard to public facilities and bank stability, activities implemented under the RGP will maintain habitat features and function provided by LWD and riparian vegetation for steelhead. As such, project activities will not result in detectable impacts to steelhead.

8. Habitat Degradation from Sand and Gravel Bar Excavation

Sand and gravel bar excavation may adversely effect water quality, habitat structure, and quality and flow regime of the stream ecosystem either temporarily or long term over a large or small area. Potential adverse effects from these activities include: temporary increases in sedimentation (discussed above), short-term loss of rearing habitat (discussed above), reduction of spawning habitat, loss of resting habitat for migrating adults, and/or reduction of edgewater habitat around sandbars for fry and juvenile rearing habitat.

Sand and gravel bar extraction authorized under this RGP is only allowed as part of channel realignment during channel restoration activities. Sand and gravel bar excavation for channel restoration will occur only in areas where high storm flows have eroded banks or scoured new channels through the floodplain. These conditions occur only after very large storm events that do not occur in most years. Areas where channel realignment is conducted likely would have high levels of disturbance to channel morphology and/or riparian vegetation and would provide marginal habitat for spawning or rearing. Given the disturbed condition of the project areas, adverse effects from excavation activities are not expected to degrade the habitat beyond conditions at the time of project implementation. Furthermore, excavation activities can only be conducted between July 1 and October 31 of each year and only in a dry stream channel, and must be restored prior to October 31 of each year. This timing avoids upstream migration and spawning of adults and downstream migration of adults and smolts.

Based on MPWMD geomorphic analysis and past experience, the design criteria for channel realignment, as described in the *Project Description*, is expected to avoid instability and braiding, allow for the development of in-channel bars within two to three years of average winter flows, and allow for rapid development of riparian vegetation. With implementation of these criteria, limitation of channel alignment activities to highly degraded areas, and minimization measures described in the *Project Description*, channel excavation activities are not expected to result in measurable effects to steelhead.

9. Bank Hardening and Associated Habitat Loss and Long-term Channel Changes (Bank Stabilization, Rock Slope Protection, Gabion Baskets)

Bank stabilization completed under this RGP could include the use of riprap and gabion baskets. Riprap consists of one or more layers of rock placed along a stream bank and/or dug into the toe of the channel to prevent erosion. Gabion baskets consist of wire mesh baskets filled with cobble-size rocks. Gabions are placed only on steeply eroded banks which, usually due to lack of space, cannot be sloped back at a 2:1 grade.

Adverse effects associated with riprap and gabion baskets include: loss of riparian habitat (discussed above); reduction of coarse sediment into steelhead habitat -- under some circumstances, eroding banks may provide spawning gravel; reduction of steelhead rearing habitat by lining irregularly shaped stream banks with fairly uniform quarry rock; suppression of natural channel migration and prevention of natural successional development of riparian gallery forests; scouring behind stone revetments and erosion from eddies formed at the ends of poorly designed riprap placement; failure of gabion baskets over time resulting in increased bank erosion and potential impingement of fish on collapsed wire mesh; an increase in stream velocity by reducing the resistance of the stream bank; an increase in bank erosion downstream on the opposite bank; and disruption of sediment layering and bringing up fine sediments that create a sediment plume from construction of toe trenches in the streambed. These effects reduce the variety and total amount of usable rearing, escape, and resting habitat for salmonids, as well as the productivity of spawning gravel, riffles (where much forage production occurs), and stream edges (for fry).

Rock revetment sites have been found to harbor more piscivorus predators than naturally eroding banks with riparian vegetation. Conversely, juvenile salmonids were found in greater abundance at natural bank sites or areas with riparian habitat rather than riprapped areas (Michny and Hampton 1984). When large linear segments of river banks are riprapped, the migrating juveniles must navigate through an area which may harbor more predators and offer little to no cover. Continued maintenance of denuded levees and riprapped banks eliminates the potential for revegetation and recovery of quality nearshore habitat for juvenile steelhead. Studies have shown high preference of juvenile salmonids for natural shoreline areas, indicating that continued suppression of habitat could hinder the successful rearing of juvenile salmonids (USFWS 1993). Through the reduction or elimination of protective shading and cover, juvenile steelhead are likely to be at a greater risk of predation or mortality due to physiological stress from lack of cover and increased water temperatures.

Approximately 50 percent of the streambanks in the Carmel River between RM 2 and RM 11 have been structurally hardened using a variety of materials. The difference in juvenile density between areas with and without bank hardening has not been evaluated. Confounding factors, such as distance upstream, water quality, and sediment composition, do not allow such comparisons from MPWMD's yearly juvenile samples. Surveys do document juvenile steelhead in restoration sites within a year of project completion, with densities within the same range as found in other upstream and downstream reaches of the survey area (MPWMD, unpublished data). These restoration sites do not include bank hardening as conducted in the past (*i.e.*, bare riprap, concrete channels), but may use vegetated riprap or gabions such in a manner proposed under the RGP.

The use of riprap and gabions as allowed under this RGP is not a continuation of past bank hardening activities that have degraded steelhead habitat. The RGP limits MPWMD-sponsored work to 2,640 linear ft of stream and private work to less than 1,000 linear ft of stream per year. Under this RGP, bank stabilization sites will require the use of biotechnical methods, unless infeasible as determined by MPWMD, to minimize the amount of riprap and/or gabion baskets installed along the streambanks. Gabion baskets, if used, will be restricted to slope areas higher than eight ft above the channel bottom. For all projects where riprap is used, LWD and willow cuttings will be incorporated into the riprap, and the riprap will be terraced with trees planted on the terraces. Interstitial spaces above ordinary high water will be imbedded with soil and planted with riparian vegetation. MPWMD has used these techniques in the past, and after three to five years, mature riparian vegetation is present along the channel banks, overhanging the channel throughout the riprap areas (Larry Hampton, MPWMD, pers. comm., September 2003). Use of vegetation within areas of riprap allows mature riparian vegetation to develop, providing cover, shade, and a source of prey for steelhead. These provisions of the RGP avoid a number of the impacts that result from bare riprap banks and levees and provide habitat for steelhead rearing and spawning.

Channel maintenance using riprap and/or gabions will occur in areas that have been washed out by high flows or that have bare banks (*i.e.*, riparian vegetation that has died from drought or water extraction leaving unstable banks). These conditions are not expected to occur every year or in all sections of the project area. Areas where project activities would be conducted are expected to have high levels of disturbance to channel banks with little or no riparian vegetation, thus providing minimal habitat function for steelhead. Because project activities will occur in degraded areas, within one year of project implementation, habitat conditions for spawning and rearing within the project area are expected to be similar or better than that prior to project implementation. Also, without project implementation, poor habitat conditions likely would persist. Nevertheless, restoration using riprap and gabions, rather than biotechnical methods that allow for a natural streambank, can negatively impact river functions and habitat carrying capacity for steelhead over the long term.

The magnitude of bank hardening due to channel maintenance or restoration activities will vary depending on the number and type of activities and the location of projects completed under each year of the RGP. From RM 15.5 to RM 18.6, the river is almost exclusively in a narrow canyon under bedrock control. No bank hardening is anticipated in this reach. Bank hardening could occur anywhere between RM 1.3 to RM 15.5, but generally is anticipated only on the outside of meander bends, where velocities are highest. The distribution and frequency of work completed in previous years will be used as a reasonable estimation of bank hardening expected under this RGP.

From 1997 to 2002, MPWMD implemented two channel maintenance and restoration projects of the type that would be implemented under the RGP. The first project encompassed 1,800 linear ft of stream channel, which equates to 3,600 linear ft of stream bank when considering banks on both sides of the channel. Within the project area, riprap was used along 1,800 linear ft of stream bank. The second project encompassed 1,500 linear ft of stream channel and 3,000 linear ft of stream bank. Riprap was used along 1,200 linear ft of stream bank. Cumulatively, these projects resulted in 3,000 linear ft of bank hardening over a period of six years. Based on these past efforts, NOAA Fisheries expects no more than 3,000 linear ft of bank hardening (cumulative including both banks) will occur during the first five years of the RGP. The analysis of effects provided in this programmatic biological opinion assumes that no more than 3,000 linear ft of bank hardening will occur during the first five years of the RGP. As discussed above, this amount of bank hardening could result in harm to threatened steelhead through temporary (one to three years) loss of habitat.

C. Beneficial Effects to Steelhead and Habitat

Fisheries habitat enhancement activities that occur under the RGP, including: placement of log and boulder groups at erosion protection locations to provide additional habitat, replacement of gravel material along the channel bottom to increase spawning and rearing habitat, revegetation of riparian habitat along the banks of the river, modification of critical riffles, and re-establishment of natural pool and riffle sequences to improve rearing and migration conditions are expected to result in long-term beneficial effects to steelhead through increased quality of spawning and rearing habitat. The magnitude and location of benefits will depend on the number, nature, success, and location of projects implemented under the RGP. As such, NOAA Fisheries is unable to quantify expected benefits. However, it is expected that long-term benefits will outweigh any short-term impacts from project implementation.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Cumulative effects on listed steelhead would occur from future water withdrawals from wells and direct diversions from the Carmel River aquifer and urban, recreational (*i.e.*, golf courses), and agricultural development within the floodplain. Water diversions would effect streamflow and water quality especially in the lowflow season. Land use activities associated with urban development, road construction, agriculture, and recreation may significantly alter fish habitat quantity and quality through: alteration of streambank and channel morphology, alteration of stream water temperatures, degradation of water quality, fragmentation of available habitats, elimination of downstream recruitment of LWD, and removal of riparian vegetation resulting in increased streambank erosion and hardening. These activities are likely commensurate with population growth. Loss of habitat quantity or decreased habitat quality can decrease successful spawning, impair growth and/or survival of early life history stages, and ultimately affect steelhead run size within the watershed.

VII. INTEGRATION AND SYNTHESIS OF EFFECTS

Assessments of steelhead abundance within this ESU show a substantial decline during the past thirty years (CDFG 1965, Nehlsen *et al.* 1991, McEwan and Jackson 1996, Snider 1983). Adult escapement data for the Carmel River above San Clemente Dam show a significant decline of 22 percent per year from 1963 to 1993, with a five-year total count of only 16 adult steelhead at the dam between 1988-1992. Since 1994, the Carmel River stock has partially recovered with a recent seven-year average (1997-2003) of 636 fish passing the ladder at San Clemente Dam.

Improved climate conditions, captive brood stock efforts, and ongoing rescue and relocation efforts likely contributed to the increase. Major factors currently affecting steelhead and their habitat in the Carmel River include construction and operation of two major dams, changes to the morphology of the river channel, water withdrawals from both surface and groundwater, hardening of channel banks, and loss of riparian vegetation.

The Carmel River Restoration and Maintenance RGP includes only those projects that avoid or minimize adverse effects and produce beneficial effects to steelhead and their habitat. The long-term goals of the activities authorized under the RGP are to minimize bank erosion and improve habitat conditions for steelhead rearing, spawning, and migration. NOAA Fisheries anticipates projects implemented under the RGP will result in take of steelhead and their habitat from capture and relocation of juvenile steelhead during dewatering/diversions and from streambank hardening.

Based on past MPWMD channel maintenance and restoration activities and spatial limitations and minimization measures included in the RGP, NOAA Fisheries expects stream bank hardening to occur to no more than 3,000 linear ft per five years of the RGP. Stream bank hardening involving use of riprap and/or gabions will occur only when pure bioengineered techniques are not feasible. Use of cement and other hardening structures is not allowed. Further requirements within the RGP, including use of vegetation and LWD, terracing, and slope/height requirements, will ensure that project areas provide habitat features and function for steelhead even when riprap or gabions are used. These techniques avoid the impacts resulting from past bank hardening techniques. Furthermore, use of riprap and/or gabions will be limited to areas that have been washed out by high flows or that have bare banks (*i.e.*, riparian vegetation that has died from drought or water extraction leaving unstable banks). Because project activities will occur in degraded areas that offer limited habitat function, within one year of project implementation, habitat conditions for spawning and rearing within the project area are expected to be similar or better than that prior to project implementation. After one to three years, habitat conditions are expected to improve significantly. Habitat likely will not recover naturally, without human restoration efforts, due to continuing water extraction that limits riparian growth. Despite expected benefits, restoration using riprap and gabions, rather than biotechnical methods that allow for a natural streambank, could result in harm to steelhead through temporary loss of habitat or through impacts to river morphology over the long term.

Mortality of SCCC steelhead due to capture and relocation is dependent upon the number and types of projects carried out annually. The RGP limits MPWMD maintenance and restoration projects to 2,640 linear ft and privately-sponsored projects to 1,000 linear ft per year. Except for critical riffle modification and LWD installation, enhancement projects will be completed only in the dry stream channel and, therefore, will not require fish relocation. Critical riffle modification is limited to 600 lineal ft per year, and LWD installation is limited to 500 lineal ft per year. Based on average juvenile densities during summer months and spatial limitations and minimization measures included in the RGP, approximately 7,110 juveniles could be captured and relocated, and 142 of those juveniles could be killed due to handling per year. In addition, the analysis of effects provided in this programmatic biological opinion assumes that no more than 3,000 linear ft of bank hardening through the use of riprap or gabions will occur during the first five years of the RGP based on the available information on past efforts. This amount of bank hardening could result in harm to threatened steelhead through temporary (one to three years) loss of habitat.

Additional habitat degradation is expected from trimming of riparian vegetation, construction of equipment access points, sand and gravel bar excavation, and dewatering of project sites. These effects will be localized, temporary, and minor. Long-term benefits to habitat, including riparian habitat, water quality, and in-channel habitat, likely will compensate for any isolated, short-term adverse effects within each project area. When considered in aggregate, these types of habitat degradation from project actions are not expected to result in identifiable adverse effects to steelhead because of the spatial and temporal limitation included in the RGP. MPWMD and privately-sponsored project areas are limited spatially to no more than 3,640 ft within the 17.3-mile action area per year, and MPWMD projects are expected to occur in response to large flooding events and not in every year of the RGP (based on past MPWMD channel maintenance and restoration activities).

In summary, due to the minimization measures and spatial and temporal limitations included in the RGP, and the current status of the Carmel River steelhead run, the RGP is not expected to result in decline in steelhead abundance over ten years of implementation. Furthermore, implementation of the RGP should allow for improved habitat over ten years of implementation.

VIII. CONCLUSION

After reviewing the best scientific and commercial data available, including current status of SCCC steelhead, the environmental baseline for the action area, the effects of the proposed Carmel River Restoration and Maintenance RGP and the cumulative effects, it is NOAA Fisheries' biological opinion that the Carmel River Restoration and Maintenance RGP is not likely to jeopardize the continued existence of SCCC steelhead.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by NOAA Fisheries as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the MPWMD for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require MPWMD to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or MPWMD must report the progress of the action and its impact on the species to NOAA Fisheries as specified in the incidental take statement (50 CFR 402.14(I)(3)).

A. Amount or Extent of Take

The amount or extent of incidental take resulting from specific future actions proposed under the RGP cannot be quantified here due to uncertainty in the scope and location of these actions. Spatial limitation specified in the project description and location and extent of actions completed by MPWMD in the past allow us to identify the maximum that could occur under the RGP. In general, incidental take is expected to be in the form of mortality due to handling during capture and relocation and harm from decreased quality of rearing habitat. This harm is a result of modification to habitat within the action area. NOAA Fisheries anticipates the annual maximum amount of take of SCCC ESU steelhead from the RGP to be limited to a small portion of the Carmel River steelhead population, including capture and relocation of 7,110 juveniles, mortality of 142 juveniles, and harm commensurate with bank hardening of no more than 3,000 linear ft within the action area over five years of the RGP.

Take will be exempted by project-specific letters that tier off this programmatic biological opinion. Thus, the exemption of incidental take for future Carmel River restoration and maintenance activities under the RGP does not take effect until such time as approval of individual project applications by NOAA Fisheries has occurred, and project-specific tiering letters have been issued.

B. Effect of the Take

In the accompanying programmatic biological opinion, NOAA Fisheries determined that this level of anticipated take is not likely to result in jeopardy to the species.

C. Reasonable and Prudent Measures

NOAA Fisheries believes the following reasonable and prudent measures are necessary and appropriate to minimize take of SCCC ESU steelhead:

1. Minimize harm and/or mortality of juveniles resulting from administration of the RGP.
2. Minimize adverse effects to steelhead habitat resulting from degradation to habitat and unstable channel geomorphology.
3. Minimize mortality of juveniles resulting from capture and relocation.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the permittee must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The following terms and conditions implement Reasonable and Prudent Measure 1:

a. The Corps shall require MPWMD to provide NOAA Fisheries with notification packages for each project to be authorized under this programmatic biological opinion.

b. MPWMD may not proceed with a proposed project until a project-specific tiering letter verifying that incidental take resulting from the proposed project is authorized under this programmatic biological opinion and incidental take statement, or until 60 days from the date that the notification package is received by NOAA Fisheries has elapsed.

c. MPWMD shall monitor all projects. Monitoring shall include a comprehensive set of photographs documenting compliance with the project description and terms and conditions included in this programmatic biological opinion and the finished projects as built. A monitoring report with photographs shall be provided to NOAA Fisheries by February 1 of each year.

d. If one or more threatened steelhead is found dead or injured, the project permittee shall contact by facsimile the NOAA Fisheries South Coast Team Leader immediately. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities must be retained, placed in an appropriately sized whirl-pak or zip-lock bag, labeled with the date and time of collection, fork length, location of capture, and frozen as soon as possible. Frozen samples must be retained until specific instructions are provided by NOAA Fisheries. Contact information is as follows:

Santa Rosa Office fax (707) 578-3435.
South Coast Team Leader phone (707) 575-6064.

e. The Corps, MPWMD, and NOAA Fisheries shall complete a formal review of the RGP after year five of implementation to review the effectiveness of minimization measures included in the project description and the amount of incidental take resulting from individual projects authorized under the RGP.

The following terms and conditions implement Reasonable and Prudent Measure 2:

a. Where space allows, MPWMD shall ensure that restored banks have a slope of 2:1 or flatter.

b. MPWMD shall implement design criteria as specified in their November 5, 2001, letter to NOAA Fisheries, unless additional geomorphic analysis provides improved techniques.

c. To the extent feasible, MPWMD shall not implement or authorize channel realignment in areas where bank deformation does not threaten private or public structures.

The following terms and conditions implement Reasonable and Prudent Measure 3:

a. Any juvenile steelhead captured during RGP activities shall be relocated to areas of perennial flow within the Carmel River to avoid fish being captured and relocated more than once in a given year.

NOAA Fisheries believes that no more SCCC ESU steelhead will be incidentally taken as a result of the proposed action than capture of 7,110 juveniles and mortality to 142 juveniles per year and harm commensurate with bank hardening to 3,000 linear ft of the project area over five years. The reasonable and prudent measures and implementing terms and conditions are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of habitat modification is exceeded, such habitat modification represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the habitat modification and take and review with NOAA Fisheries the need for possible modification of the reasonable and prudent measures.

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on a listed species or habitat, to help implement recovery plans, or to develop information.

1. Incorporate the use of rock vanes and groins to reduce erosion along streambanks and reduce the need for extensive amounts of riprap on the bank slopes.

2. Assess the risk at each bridge associated with debris jams and make recommendations concerning appropriate modifications or retrofits to the bridge piers and/or abutments.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NOAA Fisheries requests notification of the implementation of any conservation recommendations.

XI. REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the proposed Carmel River Restoration and Maintenance RGP. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the action that may affect listed species in a manner or to an extent not previously considered in this opinion, (3) the action is subsequently modified in a manner that causes an effect to the listed species that is not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, for example, more than 3,000 linear ft of the project area has bank-hardening projects within the first five years of the program, formal consultation shall be reinitiated immediately.

XII. LITERATURE CITED

Alexander, G.R. and E.A. Hansen. 1986. Sand bed load in a brook trout stream. N. Am. J. Fish. Man. 6:9-23.

Ambrose, J. and D. Hines. 1998. Ten Mile River Watershed 1997 Instream Monitoring Results. Georgia-Pacific West, Inc. Fort Bragg, CA. Rep. prepared for California Regional Water Quality Control Board - North Coast Region, Santa Rosa, CA. July 9, 1998.

Barnhart, R.A. 1986. Species Profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest), steelhead. U.S. Fish and Wildlife Service. Biol. Rep. 82(11.60). 21 pp.

Bell, M.C. 1973. Fisheries Handbook of Engineering Requirements and Biological Criteria. U.S. Army Corps of Engineers, Portland, OR. Contract No. DACW57-68-C-006.

Berg, L. 1982. The effect of exposure to short-term pulses of suspended sediment on the behavior in juvenile salmonids. Pages 177-196 *in* Hartman, G.F. 1982. Proceedings of Carnation Creek Workshop: a ten year review. Canadian Department of Fisheries and Oceans, Nanaimo, British Columbia.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Can. J. Fish. Aquat. Sci. 42:1410-1417.

Berkman, H.E. and C.F. Rabeni. 1987. Effect of siltation on stream fish communities. Env. Bio. Fish. 18:285-294.

Bisson, P.A. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. N. Am. J. Fish. Man. 4:371-374.

Bryant, G.J. 1994. Status Review Of Coho Salmon Populations In Scott And Waddell Creeks, Santa Cruz County, California, Santa Rosa, National Marine Fisheries Services Southwest Region.

Busby, P.J., T.C. Wainwright and R.S. Waples. 1994. Status review for Klamath Mountain Province steelhead. U.S. Dep. Comm., NOAA Tech. Memo. NMFS-NWFSC-19. 130 pp.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon and California. U.S. Dep. Comm., NOAA Tech. Memo. NMFS-NWFSC-27. 261 pp.

California Advisory Committee on Salmon and Steelhead Trout (CACSS). 1988. Restoring the Balance. Sacramento. California Department of Fish and Game.

California Department of Fish and Game (CDFG). 1965. California Fish and Wildlife Plan, Volume I: Summary. 110 p.; Volume II: Fish and Wildlife Plans, 216 pp.; Volume III: Supporting Data. 1802 pp.

Campbell, R.N.B. and D. Scott. 1984. The determination of minimum discharge for 0+ brown trout (*Salmo trutta* L.) using a velocity response. N.Z. J. Mar. Fresh. Res. 18:1-11.

Castelle, A.J., A.W. Johnson, and C. Conolly. 1994. Wetland and stream buffer size requirements-a review. J. Env. Qual. 23:878-882.

Cedarholm, C.J. and L.M. Reid. 1987. Impact of forest management on coho salmon (*Oncorhynchus kisutch*) population of the Clearwater River, Washington: a project summary. Pages 373-398 *in* Salo and Cundy. 1987. Streamside management: forestry and fishery interactions. University of Washington Institute of Forest Resources Contribution 57.

Chapman, D.W. and T.C. Bjornn. 1969. Distribution of salmonids in streams, with special reference to food and feeding. Pages 153-176 *in*: T.G. Northcote (ed.). Symposium on Salmon and Trout in Streams. H.R. Macmillan Lectures in Fisheries. Institute of Fisheries, University of British Columbia, Vancouver, BC. 388 pp.

Cleary, R.E. 1956. Observations of factors affecting smallmouth bass production in Iowa. J. Wildl. Man. 20:353-359.

Clothier, W.D. 1953. Fish loss and movement in irrigation diversions from the west Gallatin River, Montana. J. Wildl. Man. 17:144-158.

Clothier, W.D. 1954. Effect of water reductions on fish movement in irrigation diversions. J. Wildl. Man. 18: 150-160.

Coble, D.W. 1961. Influence of water exchange and dissolved oxygen in redds on survival of steelhead trout embryos. Trans. Am. Fish. Soc. 90(4):469-474.

Cordone, A. J. and D.W. Kelley. 1961. The influences of inorganic sediment of the aquatic life of streams. California Department of Fish and Game.

Crouse, M.R., C.A. Callahan, K.W. Malueg, and S.E. Dominguez. 1991. Effects of fine sediments on growth of juvenile coho salmon in laboratory streams. Trans. Am. Fish. Soc. 110:281-286.

Cushman, R.M. 1985. Review of ecological effects of rapidly varying flows downstream from hydroelectric facilities. N. Am. J. Fish. Man. 5:330-339.

Davis, G.E., J. Foster, C.E. Warren, and P. Doudoroff. 1963. The influence of oxygen concentration on the swimming performance of juvenile Pacific salmon at various temperatures. Trans. Am. Fish. Soc. 92(2):111-124.

Denise Duffy & Associates (Duffy). 1998. Draft Environmental Impact Report for the Seismic Retrofit of the San Clemente Dam. December 23, 1998. Prepared for California Department of Water Resources.

Dettman, D.H. and D.M. Kelley. 1986. Assessment of the Carmel River Steelhead Resource, Vol. 1. Biological Investigations. Final. September 1986. Prepared for the Monterey Peninsula Water Management District.

Eaglin, G.S. and W.A. Hubert. 1993. Effects of logging and roads on substrate and trout in streams of the Medicine Bow National Forest, Wyoming. N. Am. J. Fish. Man. 13:844-846.

Eisler, R. 2000. Handbook of Chemical Risk Assessment: Health Hazards to Humans, Plants, and Animals. Volume 1, Metals. Lewis Press, Boca Raton, FL.

Ellis, M.M. 1936. Erosion silt as a factor in aquatic environments. Ecology 17:29-42.

Entrix, Inc. 2000. Final Draft Biological Assessment for the Seismic Retrofit of San Clemente Dam. January 7, 2000. Prepared for US Army Corps of Engineers, San Francisco District, CA.

Everest, F.H. 1973. Ecology and management of summer steelhead in the Rogue River. Oregon State Game Commission. Fishery Research Report 7. 48 pp.

Everest, F.H. and D.W. Chapman. 1972. Habitat selection and spatial interaction by juvenile chinook salmon and steelhead trout in two Idaho streams. J. Fish. Res. Board Can. 29:91-100.

Gregory, S.V., F. J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. BioScience 41:540-551.

Gregory, R.S., and T.G. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Can. J. Fish. Aq. Sci. 50:233-240.

Habera, J.W., R.J. Strange, B.D. Carter, and S.E. Moore. 1996. Short-term mortality and injury of rainbow trout caused by three pass AC electrofishing in a southern Appalachian stream. N. Am. J. Fish. Man. 11:192-200.

Habera, J.W., R.J. Strange, and A.M. Saxton. 1999. AC electrofishing injury of large brown trout in low-conductivity streams. N. Am. J. Fish. Man. 19:120-126.

Hall, J.D. and R.L. Lantz. 1969. Effects of logging on the habitat of coho salmon and cutthroat trout in coastal streams. Pages 355 to 376 *in*: Northcote (ed.). Symposium on salmon and trout in streams, Institute of Fisheries, Univ. of British Columbia, Vancouver.

Hayes, M.L. 1983. Active Capture Techniques. Pages 123-146 *in* L.A. Nielsen and D.L. Johnson, eds. Fisheries Techniques. Am. Fish. Soc. Bethesda, Maryland. 468 pp.

Herbert, D. W.M., and J.C. Merkens. 1961. The effect of suspended mineral solids on the survival of trout. Int. J. Air Water Poll. 5:46-55.

Hubert, W.A. 1983. Passive Capture Techniques. Pages 95-122 *in*: L.A. Nielsen and D.L. Johnson, (eds.). Fisheries Techniques. American Fisheries Society. Bethesda, Maryland. 468 pp.

Jones and Stokes Associates, Inc. 1998. Draft SupplementalEnvironmental Impact Report for the Carmel River Dam and Reservoir Project. November 13, 1998. Prepared for Monterey Peninsula Water Management District.

Karr, J. R. and I. J. Schlosser. 1978. Water resources and the land-water interface. Science 201:229-234.

Kelley, D.W. 1983. Assessment of Carmel River Steelhead Resource; Its Relationship to Streamflow; and to Water Supply Alternatives. Prepared for the Monterey Peninsula Water Management District. June 13, 1983.

Kraft, M.E. 1972. Effects of controlled flow reduction on a trout stream. J. Fish. Res. Board Canada 29:1405-1411.

Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. N. Am. J. Fish. Man. 7:34-45.

Lowrance, R., R. Leonard, and J. Sheridan. 1985. Managing riparian ecosystems to control nonpoint pollution. J. Soil Water Cons. 40:87-91.

Lowrance, R., and twelve co-authors. 1995. Water quality functions of riparian forest buffer systems in the Chesapeake Bay Watershed. U.S. Environmental Protection Agency, EPA 903-R-95-004.

McEwan, D. and T.A. Jackson. 1996. Steelhead Restoration and Management Plan for California. California Department of Fish and Game. 234 pp.

McLeay, D.J., A. J. Knox, J.G. Malick, I.K. Birtwell, G. Hartman, and G.L. Ennis. 1983. Effects on Arctic grayling (*Thymallus arcticus*) of short-term exposure to Yukon placer mining sediments: laboratory and field studies. Can. Tech. Rep. Fish. Aq. Sci. 1171.

McLeay, D.J., G.L. Ennis, I.K. Birtwell, and G.F. Hartman. 1984. Effects on Arctic grayling (*Thymallus arcticus*) of prolonged exposure to Yukon placer mining sediment. Can. J. Fish. Aq. Sci. 1241.

McNeil, W.J. and W.H. Ahnell. 1964. Success of pink salmon spawning relative to size of spawning bed materials. U.S. Fish and Wildlife Service Special Scientific Report Fisheries 469.

Michny, F. and M. Hampton. 1984. Sacramento River Chico Landing to Red Bluff project, 1984 Juvenile salmonid study. U.S. Fish and Wildlife Service, Division of Ecological Services, Sacramento, CA, prepared for U.S. Army Corps of Engineers. October 1984.

Monterey Peninsula Water Management District (MPWMD). 1999. 1998-99 Annual Report for the MPWMD Mitigation Program.

MPWMD. 2001. 2000-2001 Annual Report for the MPWMD Mitigation Program.

MPWMD. 2003. Final Guidelines for Vegetation Management and Removal of Deleterious Materials for the Carmel River Riparian corridor. March 2003.

National Marine Fisheries Service (NOAA Fisheries). 2003. Preliminary conclusions regarding the updated status of listed ESUs of West Coast salmon and steelhead. Draft report of the West Coast Salmon Biological Review Team. February 2003.

NOAA Fisheries. 1998. Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California. National Marine Fisheries Service. p. 13347-13371.

NOAA Fisheries. 1997. Fish Screening Criteria for Anadromous Salmonids. National Marine Fisheries Service, Southwest Region. (Available from NOAA Fisheries., Habitat Conservation Division, 777 Sonoma Ave., Room 325, Santa Rosa, CA 95404).

NOAA Fisheries. 1996. Addendum: Juvenile fish screen criteria for pump intakes. Developed by the National Marine Fisheries Service, Environmental & Technical Services Division, Portland, Oregon.

Nehlsen, W., J.E. Williams, and J.A. Lichatowich. 1991. Pacific Salmon at the Crossroads: Stocks at Risk From California, Oregon, Idaho, and Washington: Fisheries, v. 16.

Newcomb, T.W. and T.A. Flagg. 1983. Some effects of Mt. St. Helens volcanic ash on juvenile salmon smolts. Mar. Fish. Rev. 45:8-12.

Nordwall, F. 1999. Movement of brown trout in a small stream: effects of electrofishing and consequence for populations estimates. N. Am. J. Fish. Man. 19:462-469.

Phillips, R.W. and H.J. Campbell. 1961. The embryonic survival of coho salmon and steelhead trout as influenced by some environmental conditions in gravel beds. Annual Rep. Pac. Mar. Fish. Comm. 14:60-73.

Platts, W. S. 1991. Livestock grazing. Pages 389-423 *in*: W. R. Meehan (ed.). Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. Am. Fish. Soc. Spec. Pub. 19.

Redding, J.M., C.B. Schreck, and F.H. Everest. 1987. Physiological effects on coho salmon and steelhead of exposure to suspended solids. Trans. Am. Fish. Soc. 116:737-744.

Reiser, D.W. and T.C. Bjornn. 1979. Habitat requirements of anadromous salmonids. Pages 370-388 *in*: W.R. Meehan (ed.). Influence of Forest and Rangeland Management on Anadromous Fish Habitat in the Western United States and Canada. U.S. Department of Agriculture Forest Service General Technical Report PNW-96.

Reiser, D.W. and R.G. White. 1988. Effects of two sediment size-classes on survival of steelhead and chinook salmon eggs. N. Am. J. Fish. Man. 8:432-437.

Reynolds, J.B. 1983. Electrofishing. Pages 147-164 *in*: L. A. Nielsen and D. L. Johnson (eds.). Fisheries Techniques. Am. Fish. Soc. Bethesda, Maryland. 468 pp.

Reynolds, J.B., R.C. Simmons, and A.R. Burkholder. 1989. Effects of placer mining discharge on health and food of Arctic grayling. Water Res. Bull. 25:625-635.

Sharber, N.G. and S.W. Carothers. 1988. Influence of electrofishing pulse shape on spinal injuries in adult rainbow trout. N. Am. J. Fish. Man. 8:117-122.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Trans. Am. Fish. Soc. 113:142-150.

Snider, W.M. 1983. Reconnaissance of the steelhead resource of the Carmel River drainage, Monterey County. Calif. Dep. Fish Game, Environmental Services Branch Admin. Rep. 83-3., 41 p. (Available from California Department of Fish and Game, Inland Fisheries Division, 1416 Ninth Street, Sacramento, CA 95814).

Tagart, J.V. 1984. Coho salmon survival from egg deposition to fry emergence. Pages 173-182 *in*: J. M. Walton and D. B. Houston (eds.). Proceedings of the Olympic Wild Fish Conference. Peninsula College, Port Angeles, Washington.

Tappel, P.D., and T.C. Bjornn. 1983. A new method of relating size of spawning gravel to salmonid embryo survival. N. Am. J. Fish. Man. 3:123-135.

Thompson, K. 1972. Determining stream flows for fish life. Pages 31-50 *in*: Proceedings, Instream Flow Requirement Workshop. Pacific Northwest River Basin Commission, Vancouver, WA.

Titus, R.G., D.C. Erman, and W.M. Snider. *In prep.* History and status of steelhead in California coastal drainages south of San Francisco Bay. Draft dated 1999.

U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries. 1998. Consultation Handbook: Procedures for Conducting Consultations and Conference Activities Under Section 7 of the Endangered Species Act. 148 pp.

USFWS. 1993. Revised draft of the Fish and Wildlife Coordination Act, Section 2(B) Report for the Sacramento River Bank Protection Project, Contract 42A. Prepared for the U.S. Army Corps of Engineers, Sacramento by the U.S. Fish and Wildlife Service, Ecological Services, Sacramento, California. 62 pp with appendices.

Velagic, E. 1995. Turbidity study: a literature review. Prepared for Delta planning branch, California Department of Water Resources by Centers for Water and Wildland Resources, University of California, Davis.

Wang, L., J. Lyons, P. Kanehl, and R. Gratti. 1997. Influences of watershed land use on habitat quality and biotic integrity in Wisconsin streams. Fisheries 6:6-12.

Waters, T.F. 1995. Sediment in streams: sources, biological effects, and control. Am. Fish. Soc. Mon. 7.

Welsch, D.J. 1991. Riparian forest buffers: functions and design for protection and enhancement of water resources. USDA Forest Service, NA-PR-07-91, Radnor, Pennsylvania.

Wesche, T.A., C.M. Goertler, and C.B. Frye. 1987. Contributions of riparian vegetation to trout cover in small streams. N. Am. J. Fish. Man. 7:151-153.

Whitman, RP., T.P. Quinn and E.L. Brannon. 1982. Influence of suspended volcanic ash on homing behavior of adult chinook salmon. Trans. Am. Fish. Soc. 111:63-69.

Zeigenfuss, L.F. 1995. The effects of electrofishing and electrofishing induced injuries on the return and growth of rainbow trout. MS Thesis. Colorado State University. Ft. Collins, Colorado. 53 pp.